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STUDIES ON COFFEE ROOT DISEASE IN PUERTO RICO

I. A COFFEE FUSARIUM WILT

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INTRODUCTION

Among the numerous diseases of coffee (*Coffea arabica* L.) reported throughout the coffee-growing areas of the world, those causing root troubles are the least understood. Very little research, comparatively speaking, has been conducted on these root maladies and in many instances no experimental evidence has been presented in the literature as to the pathogenicity of the organisms reported associated with them. In the case of the *Rosellinia* or black rot, primary attention has been paid to mycological details. Most of the information gathered in regard to this malady is

based on sporadic and incomplete reports from the Antilles and on infected material collected for identification.

In Puerto Rico, black rot is considered a limiting factor in the commercial production of this crop (32). The reports available from local agricultural institutions dealt with the description of the disease and its occurrence throughout the coffee-growing region of the Island; based upon the examination of infected material they recorded the presence of the fungus *Rosellinia bunodes* (Berk & Br.) Sacc. No experimental evidence on the pathogenicity of this organism has been presented.

Pathogenicity tests with this organism¹ were conducted by the author at the University of Wisconsin during the academic year 1938-39. Our repeated trials for inducing coffee black rot or wilt under varying conditions of soil and air temperature met with failure.

The first publication on the coffee root diseases was made by Fawcett (29) in 1916. The work included a survey of the coffee diseases already present in the Island, and general description of their occurrence, symptomatology, the pathogen when known, and measures of control. In reference to the black root rot of coffee, he mentioned a *Rosellinia* sp., without proving its relation to the malady. In 1920, Matz (42) published a popular paper in which he attributed the cause of the disease to *Rosellinia bunodes*. In 1924 Kern and Whetzel (38), while working on a mycological survey of the Island, pointed out that abundant perithecia of a *Rosellinia* sp. were found in the coffee plantations on rotting wood and on organic matter in the soil, and that in all probability this organism had something to do with the coffee root rot. In 1926 and 1929, Tucker (71, 73) wrote on the same subject; his papers were of a popular nature. He mentioned, however, that the *Rosellinia* sp., considered responsible for the malady in Puerto Rico, had been identified as *R. bunodes*. According to Petch (48), who studied material from Puerto Rico, the organism resembled more closely *R. goliath* Speg., reported previously from Brazil. Material containing perithecia was collected by C. E. Chardón, R. A. Toro and J. Guisacfré in Puerto Rico on diseased coffee trees and determined by Shear and Miller (43), as *Rosellinia bunodes*.

In addition to the species mentioned above, *R. aquila* Fries, *R. mutans* (Cooke & Peck) Sacc., *R. paraguayensis* Starb., *R. pulveraceae* (Ehr.) Fuckel, and *R. subiculata* (Schw.) Sacc. have been reported in Puerto Rico. *R. pepo* Pat., *R. St. Cruciana* Ferd. & Winge, *R. metachroa* Ferd. & Winge, and *R. necatrix* (Hart) Berl. have been reported from the Lesser Antilles and from other parts of the world. Some of these fungi have

¹ A pure culture of the fungus *Rosellinia bunodes* (Berk & Br.) Sacc. was obtained through the courtesy of J. Guisacfré and used for this work

been considered saprophytes, while *R. pepo*, *R. aquila* and *R. necatrix* and others were referred to as virulent parasites.

The literature on coffee root diseases caused by fusaria has not been abundant. Avena-Saccá (7) reported from Brazil the presence of *Fusarium heterosporium* Saccá. and *F. pallens* on the roots of diseased coffee trees. The latter fungus was found associated with a *Rosellinia* sp. and also in coffee roots attacked by nematodes. In 1916, Fawcett (29) reported a *Fusarium* attacking coffee plants in Puerto Rico and doing damage to the bark. He believed that the fungus gained entrance through wounds. Pathogenicity studies conducted by this worker showed that the disease can be produced by inoculating plants with pieces of diseased tissues; notwithstanding, he failed to induce it by inoculation with a pure culture of the organism. In 1931, Arndt and Dozier (8) reported the presence of *F. martii* following injury by the coffee cricket, stating that as a result of the attack of the fungus, the cortex became black and the trees wilted. In 1932, Picado (50) found a species of *Fusarium* causing great damage to coffee trees in Costa Rica. He named the imperfect form of the organism *Fusarium anisophilum* and the perfect stage *Nectria anisophila*. Other fusaria reported from various countries throughout the coffee-growing regions of the world are: *F. coffeicola* Henn., *F. lateritium* Nees var. *Longum* Wl., *F. cumartii* Carp., and *F. lateritium* Nees, var. *majus*.

SYMPTOMS

Under field conditions, the disease was recognized by the sudden yellowing and wilting of the foliage. The leaves showed the first symptoms of chlorosis in the parenchyma tissues between the vascular elements. Gradually, the yellowing spread over the whole leaf. In very severe cases the chlorosis was produced rapidly. The affected leaves became brown and eventually died, and were shed. The whole tree wilts and becomes dry. In affected trees, the lower part of the stem and the roots showed an advanced case of cortex deterioration accompanied by a blackening of the affected areas. Upon peeling, the stems disclosed mycelial threads of fungi. The woody part revealed black vascular strands running lengthwise and crosswise. These symptoms were frequently used for diagnostic purposes.

In our work with young coffee seedlings under one year of age, the symptoms expressed were alike in many respects. In affected seedlings, particularly in those where wilting is the characteristic symptom, the foliage became chlorotic before wilting. Seedlings kept growing on a moderately wet substratum showed symptoms of wilt without much rotting of the stem at the substratum level. In those kept on a relatively wet

substratum and under a high relative humidity, symptoms of damping-off were predominant. The lower part of the stem near the substratum level at first became water-soaked, later turned dark and soft, and finally deteriorated. The pathogen developed a vigorous growth in the affected tissues and ascended the stems up to the leaves; in some cases the latter also being invaded.

Most of the seedlings showing damping-off wilted even before the yellowing symptoms developed. When affected seedlings were pulled up they disclosed an advanced deterioration of the cortex tissues. Affected roots were tinged black. Internal symptoms of the disease included the necrosis of vascular elements, particularly the xylem vessels. Some of these vessels were enlarged as compared with healthy ones, and some were filled with an ochreous substance. No indication of mycelial penetration was observed in such vascular elements. The roots showed a similar symptomatology.

MATERIALS AND METHODS

Isolates

Isolations were made by the writer in July 1939, from diseased coffee trees which were found at Mr. A. Sastre's farm in Utuado, and which showed the characteristic symptoms of black rot. The usual precautions with respect to the technique of isolation were taken. A *Verticillium* sp. was repeatedly isolated from the bark of diseased trees. Morphologically, this fungus resembles *V. lycopersicii* Pritchard.

In making isolations from the innermost tissues of the wood of stem and roots the following technique was followed: the cortex was peeled off and the exposed woody tissue with its characteristic vascular strands was flamed. From the deeper, unburnt tissues of the wood, pieces of infected material were cut off and placed on potato dextrose agar. After a week or two a slow growing fungus developed in many of the plates. A microscopic examination revealed it to be a *Fusarium* sp. belonging to the section *Elegans*. This *Fusarium* resembles morphologically *F. bulbigenum* var. *batalatis*, as pointed out by Dr. Sherbakoff, to whom the organism was sent for identification. This *Fusarium* was found, as will be shown later in this work, to be responsible for coffee black rot and wilt. A species of *Fusarium Solani* occurred as a contaminant. See fig. 1.

Growing coffee seedlings

In growing coffee seedlings for our experimental work, efforts were made to avoid natural contaminations and infections from root rot agents. Fresh coffee seeds were surface disinfected with a 1 to 1000 mercuric bichloride solution and then rinsed thoroughly in distilled water to remove

the toxic salt. The treated seeds were left soaking overnight in distilled water, and then sown on flats in soil sterilized for four hours at 15 pounds pressure, then left for a week. The seed started germinating within a month. All coffee seedlings have been kept growing under a lath half

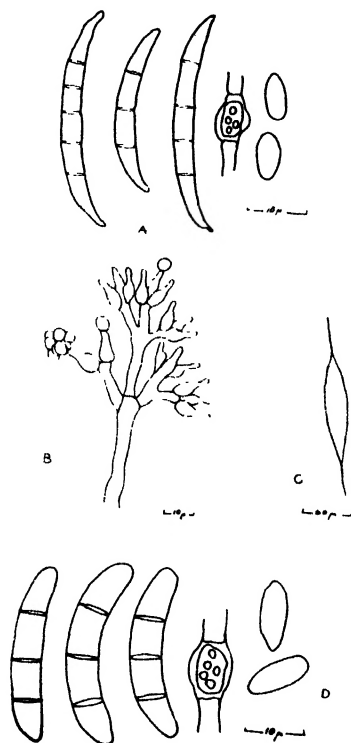


FIG. 1 Camera lucida drawings of isolates. A. Conidia and chlamydospore of *Fusarium bulbigenum* var. *coffeae* grown on potato-dextrose-agar, B. Conidiophore and conidia of *Verticillium* sp. grown on potato dextrose agar, C. Conidia and chlamydospore of *Fusarium Solani* sp. grown on potato-dextrose-agar; D. Ascospore of *Rosellinia bunodes* from perithecium found on dead coffee wood.

shade and are watered regularly with boiled or sterile water. In no instance have symptoms or signs of disease been observed among the seedlings.

METHOD OF INOCULATION

Our repeated trials for inducing coffee black rot by planting coffee seedlings in naturally contaminated soil met with failure. The new isolates, as well as the *R. bunodes*, were tested for pathogenicity using Wellman's (75) technique for "studying host resistance and pathogenicity in

tomato fusarium wilt." The method consists in immersing recently pulled seedlings, without particular care for root pruning, in a mycelial and spore suspension of the inoculum, before transplanting to sand cultures.

PREPARATION OF THE INOCULUM

Coon's solution was found satisfactory for the growth of the isolates as well as for the development of coffee seedlings; consequently, it was decided to use it in our work (fig. 2.) The medium consists of: saccharose, 7.2 grams; dextrose, 3.6 grams; potassium nitrate, 2.02 grams; magnesium sulphate, 1.23 grams; potassium acid phosphate, 2.12 grams; and water, 1 liter. Electrometric determination of the pH of the solution showed it to be 4.53.

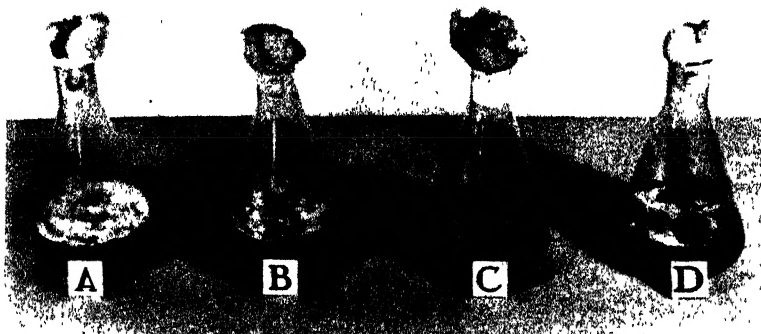


FIG. 2. Coffee root isolates growing in Coon's solution at a temperature of 28°C. A. *Fusarium bulbigenum* v. *coffae*; B. *F. solani*; C. *Rosellinia bunodes*; D. *Verticillium* sp.

One hundred cubic centimeters of the solution were poured into 250 cc. flasks and autoclaved for thirty minutes at 15 pounds pressure. Cultures of the isolates were made by seeding the sterile solution with pieces of agar cultures of the different organisms. The cultures were agitated twice during the second day and thereafter left undisturbed. They were incubated at 28°C. for 5 days.

In the preparation of the inoculum, care was taken to decant the liquid from each culture. The mycelial mat was then transferred to another flask containing 100 cc. of fresh, sterile Coon's solution. The mat was well shaken to break it up into small fragments. One hundred cc. of the inoculum were found sufficient to inoculate 100 seedlings.

EXPERIMENTAL RESULTS: THE PATHOGEN; CULTURAL CHARACTERS

Fusarium bulbigenum Cke. et. Mass. v. *coffae* v. n. This organism was found to be the cause of a coffee wilt and black rot in Puerto Rico.

It resembles, morphologically, the fungus *F. batatas* var. *vanilla*, reported by Tucker (72) as the pathogen responsible for vanilla wilt in Puerto Rico. Tucker has shown that the vanilla wilt parasite is not pathogenic to coffee.

Our work has demonstrated that the *Fusarium* causing the coffee wilt and black rot is not pathogenic to vanilla.

The coffee wilt *Fusarium* grew well in many kinds of culture media.

On potato dextrose agar the mycelium grew abundantly, was white at first and turned with age to reddish or vinaceous. Chlamydospores were produced in old cultures. Macroconidia were abundant, produced in white or colored sporodochia, sickle-shaped, pedicellate, slightly constricted at the septa and densely granular. They were generally three-septate, and varied in length from 18 to 36 by 3.0 to 4.0 μ in width. Two, four and five-septate spores were less frequently produced. Microconidia, generally non-septate, were produced in false heads.

On potato plugs the mycelium was white, abundant, and constricted at the septa, later forming either terminal or intercalary chlamydospores, the latter measuring from 5 to 12 μ by 6 to 12 μ . The substratum was not changed in color. Macroconidia were formed abundantly, and were granular, pedicellate, slightly constricted or not. The spores were rather large and with one or more intercalary chlamydospores when old; they were generally three or four-septate and sometimes five-septate. Three-septate spores measured from 30 to 42 μ by 3.0 to 3.7 μ , four septate spores from 30 to 45 μ by 3.0 to 3.7 μ , and five-septate spores from 33 to 45 by 3.0 to 3.5 μ . Microconidia were abundant, the great majority being non-septate and from 6 to 15 by 3.0 to 3.5 μ .

On 5 per cent dextrose agar the mycelium grew rapidly changing with age to a reddish or vinaceous color. No chlamydospores were observed in cultures fifteen days old. Macroconidia are borne in sporodochia or in false heads, abundantly three-septate, sickle-shaped, densely granular, pedicellate and measuring from 16.75 to 33 μ by 3.0 to 3.5 μ . One, two, four, five and six-septate spores were relatively few. Non-septate microconidia were abundant and measured from 3 to 12 by 2.0 to 3.0 μ .

On steamed rice the aerial growth was white. The substratum changed gradually to reddish or vinaceous, particularly at the bottom of the flask. In older cultures the mycelium turned a deep blue. Macrospores were born abundantly on reddish or white sporodochia, generally three-septate, with a few six-septate spores. Three-septate spores measured from 30 to 45 by 3.0 to 3.5 μ , four-septate spores from 36 to 45 by 3.0 to 3.5 μ . A pleasant aroma was emitted by the cultures.

On oatmeal agar the mycelium was less abundant, with abundant chlamydospores intercalary or terminal, single or in chains, the larger measuring from 6 to 12 μ by 6 to 12 μ , thick-walled, densely granular.

Microconidia were produced in salmon-colored masses or were brown in sporodochia at the bottom of the slant, where the substratum was tinged slightly with lilac. Abundant three-septate macroconidia were produced and measured from 18 to 39 μ by 3.0 to 3.5 μ . Few four-septate spores were formed. These, as well as other cultures studied, were incubated at 28°C.

Fusarium bulbigenum Cke. et Mass. v. *coffeeae* v. n.

"Macroconidiis is sporodochiis salmonis colore instratis, 3-6 septatis, falcatis, pedicellatis, 3-septatis: 16.75-45.0 x 3.0-3.7 μ , microconidiis 6-12 x 2.0-3.5 μ . Chlamydosporis terminalibus it intercalaribus, singularis vel catenulatis."

Macroconidia sickle-shaped, hyaline, pedicellate, not constricted when young, usually three-septate and measuring from 16.75 to 45 μ by 3.0 to 3.7 μ . Occasionally one and two-septate conidia formed. Four and five or six-septate conidia produced. On potato plugs four-septate conidia were relatively abundant. Microconidia abundantly non-septate, oval or ellipsoidal, measuring from 6 to 12 by 2.0 to 3.5 μ . Chlamydospores formed in old cultures either terminal or intercalary, single or in chains. Substratum in oatmeal agar tinged lilaceous; in potato dextrose agar reddish to vinaceous to bluish. Spores formed in salmon colored masses or on sporodochia. Sporodochia either white or tinged; observed in potato-dextrose agar, oatmeal-agar and steamed rice cultures.

Growth temperature relations

The relation between growth of the isolate and temperature was observed in order to provide further elucidation concerning the effect of the environment on the development of coffee wilt and black rot. Five millimeter disks containing mycelium from each respective isolate were removed with a sharp-edged steel tube from five-day-old cultures of the fungi grown on potato dextrose agar. The cultures were kept at the temperature at which the growth rate was to be determined. The mycelial disks were cut just back of the growing point of each colony so as to describe a concentric circle. In this manner the greatest uniformity is secured not only in size, shape and age, but also in the amount of mycelium taken. Petri dishes containing 15 cc. of 2 per cent dextrose agar, of pH 6.14, were planted with the respective mycelial disks of the isolate. The disks were placed in the center of the medium. Triplicates of each isolate were immediately incubated at temperatures of from 10 to 36°C. Measurements of daily increments of radial growth were taken, as well as the total growth in a period of seven days. The results are shown in table 1.

It may be seen that the pathogen is benefited, as far as development is concerned, by high temperatures. The limits for optimum growth are from 24° to 30°C. This temperature range is more or less that prevalent in Puerto Rico.

TABLE 1

Seven-day growth temperature relation of culture of the isolates grown on potato dextrose agar, pH 6.14. Average daily increment in cm. of three cultures in each treatment

Degrees C	Average Daily Growth in Cm. of <i>F. bulbigenum</i> var. <i>coffae</i>
10	0.20
12	0.37
16	0.46
20	0.85
24	1.24
26	1.45
28	1.45
30	1.24
32	0.70
34	0.39
36	0.00

Relation between hydrogen-ion concentration of the substratum and growth

The growth of the pathogen on a substratum with varying pH values was considered of interest, not only from the point of view of the physiologic phenomenon itself, but also with respect to the relation between its behavior at each pH value and the development of the disease.

TABLE 2

Average daily increment of growth of isolates when grown on 2 per cent potato dextrose agar for seven days at 28°C., at different initial pH values of the substratum
Growth in cm

Initial pH	Average Daily Growth in Cm. of <i>F. bulbigenum</i> var. <i>coffae</i>
3.51	0.64
4.00	0.94
5.12	1.20
6.14	1.45
6.47	1.20
7.32	1.21

These studies, as well as others conducted in our work, have been made with virulent and monosporial cultures of the pathogen.

Petri dishes with 15 cc. of 2 per cent potato dextrose agar medium, adjusted to varying pH values either by the addition of the necessary amounts of dilute sodium hydroxide or hydrochloric acid solutions, were

seeded as previously explained, with five mm. mycelial disks removed from five-day-old cultures of the isolate. Triplicates were incubated at 28°C. for seven days and daily increments of radial growth recorded. A solid culture medium was selected. The disadvantage of using dry weight in the determination of fungal growth has been shown by Brown (18). The results are presented in table 2. These results show that the pathogen develops without much difference in growth rate within pH values of 5.00 to 7.00. It is pertinent to mention here that this range is much wider than that for the coffee soils in Puerto Rico, which vary from pH 4.50 to pH 6.00, though a great number of coffee soils are closer to the lower pH value. Growth of the isolates in Coon's solution, adjusted to pH values of 4.53, 5.55, 6.00, 6.49, 7.32 and 7.95; was abundant.

Effect of filtrates on cut coffee seedlings

At the end of four weeks, cultures of the pathogen grown in Coon's solution of pH 4.53 were filtered through a Chamberlain bacterial filter and the filtrates checked for contamination. One hundred cubic centimeters of each filtrate were poured into parallel flasks. One set of each filtrate was then boiled for fifteen minutes and allowed to cool to room temperature. Young coffee seedlings with four pairs of opened leaves were then cut under water and immersed in each boiled and untreated set respectively, and left for two days for observation. Other seedlings (placed in the unboiled filtrate of *F. bulbigenum* var. *coffae*) showed wilting and chlorotic leaf symptoms similar to those observed in diseased coffee trees. The seedlings in the boiled and sterile Coon's solution were turgid and showed no indication of physiologic disturbance.

In 1932, Picado (49) obtained similar results with filtrates from four-week cultures of *F. anisophyllum* grown in Richard's solution. He inferred that wilting of the coffee seedlings was in all probability due to a toxic action effective at a distance and capable of inducing a chlorotic condition and shedding of the leaves. Brandes (17) found that *F. oxysporum* Schl. var. *cubense*, responsible for the banana wilt, when grown for two weeks on Richard's and Uschinsky's solutions yielded filtrates producing wilt of buckwheat plants, banana leaves, and bean plants. The filtrates were thermolabile.

Pathogenicity

On November 29, 1939, a mixture of one part of well-rotted manure and two parts of river-bottom soil was potted in clay pots and autoclaved for four hours at 15 pounds pressure. The soil was left for a week, before it was used. The pH of the mixture was found to be around 6.00.

Young coffee seedlings, variety "Puerto Rico," of approximately 3 months growth were inoculated with each of the isolates, following the technique used by Wellman. Seedlings were transplanted in groups of ten, immediately after dipping the roots in the inoculum and while still dripping. Thereafter, the seedlings were kept under a capillary water dripper so as to maintain a wet substratum at all times. The seedlings stayed under these conditions for three months and in no instance were symptoms of disease produced. Control plants similarly treated but not inoculated, were growing inside the greenhouse under a temperature which fluctuated between 20 and 30°C., as recorded by a thermograph.

On February 2, 1939, the same procedure in testing for pathogenicity of the isolates was followed. This time, however, the soil was saturated at the time of transplanting of the seedlings and allowed to evaporate gradually, but not to the extreme of becoming too dry. Water was then again added to saturate the soil and the process was repeated regularly. The controls and inoculated seedlings were kept in this manner for two months and during this time only 12 per cent of the seedlings inoculated with the *Fusarium bulbigenum* var. *coffea* displayed symptoms of disease. The affected seedlings became chlorotic and eventually wilted. The air temperature fluctuated between 20 and 32°C. Repetition of this work, however, gave erratic results.

In view of these results with plants grown on soil, it was decided to conduct further experiments with coffee seedlings kept growing this time in sand culture, to which Coon's solution was added as a source of nutrients. In this manner, variability in soil characters, contaminations with other organisms, and other factors affecting the coffee seedlings and the pathogen are materially avoided.

Coffee seedlings with one pair of leaves well opened, were pulled from the flats, dirt washed from the roots, and the seedlings immediately immersed in the respective inoculum and transplanted into sand cultures. The pH of the sand substratum was determined electrometrically and found to be 5.53 after the addition of the Coon's solution. These seedlings were inoculated on December 15, 1939, and kept growing on a saturated sand substratum, an automatic water feeder being used for the purpose of saturation. Under these conditions, the incidence of disease was very low, only 10 per cent of the seedlings inoculated with the *F. bulbigenum* var. *coffea* showing symptoms of disease. (The symptoms of disease.) The symptoms appeared 21 days after inoculation and were initiated with a root and stem rot of the seedlings.

Coffee seedlings when inoculated and planted on a and substratum of pH 5.53, and saturated only at the time of planting, showed black root and crown rot within 10 days after inoculation with *F. bulbigenum* var.

coffea. The seedlings were kept under bell jars at all times to prevent excessive drying of the sand as well as to provide a high relative humidity around them. None of the other isolates were capable of inducing disease.

The results of this and other greenhouse experiment have shown that inoculated coffee seedlings when grown on a very wet substratum are less liable to become infected than when kept growing on a moderately wet substratum or on one with a fluctuating water content. Wardlaw (74) found a similar behavior with respect to the infection of banana roots with *F. oxysporum* var. *cubense*.



FIG. 3. Damping-off of coffee seedling inoculated with *F. bulbigenum* v. *coffea*. Seedlings grown in sand culture.

Succulent coffee seedlings with one or two pairs of leaves become infected a short time after inoculation. The typical symptom of disease is the rotting of the stem at the substratum level. Damping-off is produced on a moderately wet substratum and at a high relative humidity (fig. 3).

Picado (49), working with a *Fusarium* wilt in Costa Rica, indicated his failure to produce infection with coffee seedlings under one year of age. He attributed the lack of infection to the high content of caffeine found in small seedlings. Our work has shown that with our pathogen the percentage of infection is very high under suitable conditions for its development. Pathogenicity studies with plants over one year of age will be conducted in the future.

A combination of the isolates grown independently in Coon's solution, was made to determine the relation between their behavior when in association and the incidence of disease. The same procedure followed for other experiments also was carried out in this one. In every combination where the pathogen *F. bulbigenum* var. *coffea* was present, symptoms of disease appeared within a short time.

Effect of pH of the substratum on the production of the disease

The relation between the hydrogen-ion concentration of the substratum and the development of disease has been studied for other *Fusarium* wilts. Scott (53) has shown that the incidence of tomato *Fusarium* wilt due to *Fusarium lycopersicii* Sacc. is less frequent at pH values between 6.4 to 7.0, and that a maximum for disease manifestation lies on each side of the pH range.

On March 13, 1940, several experiments were undertaken to establish the relation of the hydrogen-ion concentration of the substratum to the incidence of coffee *Fusarium* wilt. Parallel tests were conducted with seedlings of the same age. The coffee seedlings were kept growing under identical conditions of substratum moisture content, relative humidity, substratum and air temperatures and amount of inoculum present. The pH value of the substratum of each set of plants under observation obviously was different. Coon's solution was used after being modified to give different pH values by the addition of potassium acid phosphate and potassium dibasic phosphate in various proportions; but always keeping chemical equivalent quantities as that supplied by the potassium acid phosphate in the original solution. Dilute hydrochloric acid and sodium hydroxide were used whenever necessary.

To each of four pots of one gallon capacity filled with washed, white granitic sand, was added one liter of the respective solutions, whose pH had been determined electrometrically. This amount of solution per pot was found to be enough to saturate the sand. After two hours of incorporating the solutions, the pH of the substratum was again determined and recorded as the initial pH. The plants were then inoculated and transplanted as explained previously and kept growing under bell jars inside the greenhouse. The temperature of the substratum fluctuated between 20 and 32°C., the air temperature between 20 and 38°C.

Table 3 indicates that coffee *Fusarium* wilt is more likely to occur at low than at high pH values of the substratum, provided all other conditions for infection are maintained. Whether the high acidity has a bearing on the virulence of the pathogen or is lowering the resistance of the host, is something that cannot be explained from these data. The range for infection

and that for growth of the causal agent are not identical, as the organism is able to grow abundantly within a wider range of pH values. Its growth was profuse within the range of pH 4.5 to 8.68. The limits for growth were not determined.

TABLE 3

Incidence of coffee Fusarium wilt on seedlings grown at varying pH values of the substratum for two months

(Each figure represents date of 20 plants per pot)

Initial pH of Substratum	Final pH of Substratum	Average Time for Expression of Symptoms	Amount of Diseased Plants by the End of the Experiment
		<i>days</i>	<i>per cent</i>
4.53	6.08	7	100
5.53	6.37	11	65
5.57	6.37	15	60
5.97	7.91	7	100
6.00	6.64	21	40
6.49	8.17	0	0
7.32	8.10	0	0
7.95	8.17	0	0
Controls for all pH values.		0	0

Relation between temperature and disease

In previous experiments it was observed that the incidence of *Fusarium* wilt is very high in inoculated coffee seedlings kept growing within an environment of fluctuating substratum and air temperatures of from 20 to 32, and 20 to 38°C., respectively, provided that the seedlings were planted in a moderately wet and acid substratum and surrounded by a high relative humidity. High temperature is, therefore, to be considered a factor necessary for the production of infection and disease.

In order to observe the effect of constant soil and air temperatures on the incidence of the malady, 20 coffee seedlings with two pairs of opened leaves were inoculated and transplanted into sand cultures adjusted to pH 5.53 and saturated at the time of transplanting. The seedlings were then kept at all times under bell jars. Control plants were treated similarly but not inoculated. The potted plants were placed in an air-conditioned room and the temperature adjusted to 24°C.

The inoculated plants showed typical symptoms of root and crown rot within seven days. In the experiment begun February 17, 1941, all check plants remained in perfect condition while all the inoculated plants became diseased.

Picado (49) in his work with *Fusarium anisophyllum*, reported a decrease in the percentage of coffee wilt at temperatures from 18° to 22°C. Due to lack of facilities for this particular phase of the work, no further trials were conducted to determine the rate of infection on either side of the 24 to 30°C. temperature range.

The development of the disease coincides with the temperature range for optimal growth of coffee seedlings and of the organism. Our work in Wisconsin showed that coffee seedlings develop better at temperatures above 20°C.

Testing coffee varieties for resistance

Two varieties of coffee, "Columnaris" and "Puerto Rico", were compared for resistance to the malady. The plants were three months old, and were inoculated and transplanted to sand cultures as formerly explained. The results are given in table 4.

TABLE 4
Development of coffee fusarium wilt in two varieties of coffee
(Each figure represents data for 60 plants)

Variety	Initial pH of Substratum	Per Cent of Wilted Plants
Puerto Rico	5.5	100
Columnaris	do	100
Puerto Rico	7.32	0
Columnaris	do	0
Controls		0

On March 24, 1942, small coffee seedlings with one pair of cotyledonous leaves opened were tested for resistance. The seedlings were inoculated following Wellman's technique and transplanted immediately to a large iron pan painted on the inside with a chemical-proof paint and filled with granitic sand to a height of about one inch from the top. The pan was placed inside a glass box with adjustable side doors and with inside shelves for keeping the soil and air thermograph and a hygrograph. (fig. 4) The initial pH of the substratum was electrometrically determined to be 5.63. After the third day from transplanting the pH had changed to 7.15. The air temperature inside the glass box fluctuated between 22 and 40°C. The substratum temperature fluctuated between 22° and 28°C. The relative humidity was around 80 per cent except when the box was opened for examination of the seedlings. During these short periods of time the relative humidity dropped to 35 per cent.

The substratum was saturated at the time of transplanting and thereafter lost water gradually. The results are shown in table 5.

Examination of the roots of the inoculated plants showed that all the coffee varieties are susceptible to the attack of the pathogen. Owing to the fact that the pH of the substratum had changed within three days after inoculation, some of the varieties were able to recover. New roots were then formed from tissues above those diseased. These roots apparently were healthy and no infection, therefore, took place under the new alkaline pH condition in which they were thriving. Acidity of the substratum is



FIG. 4. Testing coffee varieties for resistance to infection with *F. bulbigenum* v. *coffea*.

an important factor in determining whether infection will occur. The recovery of some infected plants can be explained as a result of the selective absorption of ions either by the pathogen or the plants, leaving those ions with marked alkaline reaction, unabsorbed.

Testing for the resistance of the 28 varieties of coffee was repeated in order to obtain more elucidation on this important matter of acidity. This time the pH of the substratum was always maintained on the acid side by the use of ammonium sulphate as a partial source of nitrogen. In this manner, the selective absorption or use of the ammonium radical left the

sulphate acid radical remaining in the medium. The initial pH of the substratum as determined electrometrically was 4.44. By the end of the experiment it had changed to 5.29. This acid range lies within the pH

TABLE 5

Results of testing twenty-eight varieties of coffee of the Arabian, Robusta and Liberian Groups for resistance to coffee wilt

(Each figure represents data for 100 plants)

	Time for Expression of Symptoms	Wilted Plants in 30 Days
	days	per cent
Moca	15	40
Guadalupe	15	20
Carmelita 80	10	10
Padang	10	20
Preanger	15	20
Uganda hybrid	10	40
Murta	11	10
Ceylon hybrid	9	10
San Ramón	10	30
Erecta	9	40
Bourbon	9	40
Congensis	9	40
Excelsa	9	40
Liberica	10	30
Dewevrei	9	20
Maragogipe	10	40
Java Moca	10	30
Robusta	10	50
Congensis Chalotti	9	80
Blue Mt. Jamaica	9	80
Pantgoer	11	30
Robusta Canephora	10	70
Robusta Quillour	10	50
Marasan	11	20
Columnaris	9	40
Puerto Rico	9	30
San Kruense	9	40
Arnoldiana	9	70

range previously determined to be favorable for the development of coffee wilt.

Infected plants formed new roots above the points of infection, but these were in turn attacked. Therefore, recovery under this condition is less likely to occur. The data are presented in table 6.

TABLE 6

Results of testing for resistance to coffee wilt of twenty-eight varieties of coffee of the Arabian, Robusta and Liberian Groups, the inoculated seedlings being kept on an acid substratum

(Each figure represents data for 50 plants)

	Time of Expression of Symptoms	Wilted Plants by the End of the Experiment
	days	per cent
Moca	7	100
Guadalupe	7	100
Carmelita 80...	7	93
Padang...	7	86
Preanger...	7	73
Uganda hybrid...	7	60
Murta	9	06
Ceylon hybrid	9	20
San Ramón	10	73
Erecta	7	46
Bourbon	10	66
Congensis	7	66
Excelsa	7	80
Liberica	7	86
Dewevrei	7	20
Maragogipe...	7	36
Java Moca	7	36
Robusta	7	80
Congensis Chalotti... . .	7	66
Blue Mt. Jamaica	7	33
Pantgoer	7	33
Robusta Canephora	7	40
Marasan	7	46
Puerto Rico	7	33
Columnaris	7	33
Robusta Quillou	7	46
San Kruense	7	66
Arnoldiana	7	40

DISCUSSION AND SUMMARY

The association of the fungus *Rosellinia bunodes* (Berk & Br.) Sacc. with black root rot and wilt of coffee in Puerto Rico, and probably elsewhere, has heretofore been based merely on mycological details. In the literature consulted, there is not a single instance in which the pathogenicity of the organism has definitely been demonstrated. Its host range is still widening and includes herbs, all sorts of weeds, shrubs and trees. The fungus was abundantly found in decaying organic matter.

In the course of our investigation, the fungus *R. bunodes* has failed, in every instance and under varying environmental conditions, to induce the

disease. However, under the same environmental conditions, a *Fusarium* sp., named for the sake of identification *F. bulbigenum* var. *coffea* var. nov., and isolated from infected coffee wood showing the markings of the so-called Rosellinia root rot; was found to induce coffee black root rot and coffee wilt independently or in association with other isolates. None of the other isolates proved to be pathogenic. It seems, therefore, that, at least under our experimental conditions, the *R. bunodes* and other isolates mentioned previously in the course of this work are mere saprophytes.

The association of this and other species of *Rosellinia* with root rots of plants in the tropics have been questioned. Petch (48) working in Ceylon and Malaya, along with other workers, has indicated that among the fungi found associated with the root diseases of tea, *R. bunodes* is the least common. The cause of the red root disease of limes in Dominica is ascribed by some authors to *R. bunodes* and *R. pcpo*. Other workers believe it to be due to the fungus *Sphaerostilbe repens* Berk & Br., while Ashby (10) attributes it to the extremely wet conditions of the environment. Carruther (19) associated a *Rosellinia* species with the root disease of tea in Ceylon, but he failed to induce the disease by planting tea plants on soil contaminated with ascospores of the fungus. In the Kew Gardens in England, apple roots and seedling beeches became infected when planted in soil contaminated with diseased material from which *R. radiciperda* Mass. had been isolated; but there is doubt as to whether some other organism present in the infected material might not be responsible for the infection. Averna Saccá ((5, 6) found *Fusarium pallens* associated with *Rosellinia bunodes* in diseased coffee trees in Brazil and in plant beds attacked by a *Colletotrichum* sp. and nematodes.

Pathogenicity studies conducted with the *F. bulbigenum* var. *coffea* have shown that the incidence of the disease is favored by high temperatures and by substrata, medium to wet, or with fluctuating moisture content. Temperatures fluctuating between 20° and 36°C., as recorded by a thermograph, were favorable for the development of the disease. A constant temperature of 24°C. also was found to be adequate for the development of the disease. A substratum kept wet all times was less favorable for the development of the malady than one with a fluctuating water content. Very dry and very wet conditions seemed to be unfavorable for disease development. A high relative humidity of from 70 to 80 per cent favored the development of damping-off symptoms. In atmospheres of low relative humidity or with fluctuating humidity, the characteristic symptom is wilting with or without chlorosis. These findings conformed with field observations. Fawcett (29) found that "the disease often does most harm amongst the best trees, the sun-exposed slopes of the poor coffee plantations remaining quite free from trouble . . . the only things which retard or stop its progress seem to be excessively dry or excessively wet soils,

natural barriers, such as brooks, and the scarcity of food material (decaying vegetation) in the soil." The author had the opportunity to observe severe cases of coffee wilt at Mr. Luis Vilella's farm at Lares and at Mr. Sastre's farm at Utuado. Other coffee groves in the neighborhood around Adjuntas-Lares also were found to be heavily infected. The conditions resembled those already quoted from Fawcett.

The question of soil pH reaction and the incidence of the disease had not been elucidated previously. Coffee seedlings under one year of age were very susceptible to infection when grown on substrata with the pH varying between 4.50 and 6.50, and provided that such other factors as humidity of the substrata, temperature, and relative humidity of the atmosphere were considered. Our coffee soils fall under a pH range of from 4.50 to 6.00, though more frequently closer to the lower limit of acidity. Steinmann (63) states, however, in relation to the black root rot of tea in Java; attributed to *Rosellinia bunodes* and *R. arcuata*, that: "in contrast to most other root fungi, these species of *Rosellinia* occur almost exclusively in neutral, young, volcanic soils where the exchange acidity does not exceed 1.0 or the degree of hydrolytic acidity 55.0." He recommends that "infected areas should be isolated by trenches dug on porous soil to a depth of at least 1 m. and further. In order to increase the degree of exchange acidity in neutral soil 2.0 the limit for *Rosellinia* infection it would be necessary to apply 100 gm. of aluminum sulphate per sq. m. of soil. A more economical and probably more effective method could be treatment of the soil with alum or colloidal sulphur."

The question of the relation between the pH of the soil and the incidence of *Fusarium* wilt has promoted many debates among investigators. In the case of the Panama disease or banana wilt, the consensus of opinion favors the idea that the disease may be best reduced in soils well supplied with lime, and with a pH value of the soil above 6.00. However, there have been reports of serious outbreaks in soils rich in lime and with a high pH value. The coffee wilt organism is able to grow within a wide pH range, as was mentioned before, thus leaving the question open as to whether the organism loses virulence in an alkaline substratum, or whether the plants are less susceptible. Coffee wilt in Puerto Rico is more liable to occur in the acid soils of our highlands. Incidence of coffee wilt is less in neutral or slightly alkaline soils.

CONTROL

The control for coffee wilt, as it appears in Puerto Rico and elsewhere, has not been worked out as yet. Such recommendations as the eradication of diseased trees and contaminated material followed by the application of lime to the soil, scraping of contaminated material and then liming, pruning

of shade trees and underbrush, with pruning of lower branches of the coffee trees to allow for air circulation, and isolation of contaminated areas by deep trenches, are some of the preventive measures of control recommended. So far, however, none of these practices have been shown to be effective.

Chemical control has been attempted, but the results obtained are far from being practicable; in many instances their high cost invalidates such measures. Fawcett (29) experimented with lime, sulphur, copper sulphate, potassium permanganate, chloronaphtholeum and potassium bisulphite. Small coffee plots in contaminated areas were treated with lime and sulphur, respectively, at the rate of 500 grams per square meter. Observations over a three-year period showed no incidence of disease in the treated lots. Untreated plots revealed 5 per cent of diseased trees. Plots treated with 150 grams of sulphur and 50 cc. of a 5 per cent solution of chloronaphtholeum per square meter, respectively, showed 3 per cent of diseased trees. Chloronaphtholeum applied at the rate of 450 cc. per square meter, was found effective.

Copper sulphate solution sprayed at the rate of 20 grams per square meter was reported sufficient to check and exterminate the fungus.

In Martinique, Bordoiz (16) reported very good results with carbon bisulphide emulsion. The same measure was reported inefficient from Dominica in controlling root diseases.

Those who have dealt with the question of chemical control ascribed their good results, if any, to the fungicidal properties of the substances used. The question of the acidity of the soil and its possible relation to the root rots has sometimes been mentioned but not elucidated. Nowell (45) pointed out the possibility of inhibition of the pathogen by the application of lime to the soil with the resulting neutralization of the soil acidity. It can be recalled that in the work by Fawcett, already mentioned, successful results were obtained when using 500 grams of either sulphur or lime per square meter of soil. The former substances tends to lower the pH of the soil, while the latter tends to raise it. However, it is still a matter of doubt whether each chemical in itself was sufficient to alter materially the pH value of the soil, considering the buffer capacity of the latter.

Our work revealed, other factors considered, that for the incidence of coffee wilt, the pH value of the substratum is important, at least under greenhouse conditions. The application of lime in substantial amounts to change the pH of the soil for a relatively long period of time, and beyond pH 6.50, is an advisable control measure, in addition to other practices mentioned in the course of this report.

According to Guiscafré and Gómez (33, 34), 95 per cent of the coffee root system develops within the first 12 inches of the top soil, with an average spread of from 3 to 4 feet from the tree trunk. They also found

that the best root development occurs in soils with reaction of from pH 6.5 to 7.5. In soils with pH values of from 4.0 to 4.50 root development is lessened. Nutman (46) presents evidence on the favorableness to root development of neutral or slightly acid soils of approximately pH 5.8 to 6.0, which he considers to be the acid limit for better root growth. Nowel (45) also indicates that in all probability, the benefit of liming the soil is not to be attributed exclusively to the neutralization of the soil acidity, but also to the possible increase in the rate of decomposition of the organic matter of the soil in addition to the correcting action of the lime. Smith (56) in discussing this question, has indicated that in Jamaica the incidence of banana wilt has been decreased considerably by the addition of lime to soils in which the organic matter has been collected and buried in trenches. In our coffee plantations it is customary to pile organic matter around and close to the tree trunks. In this manner there is provided an ideal environment for the growth of fungi. Although the organic matter from leaves and decayed wood is a fine source of nutrients, why accumulate it close to the tree trunks? The absorbing area of the roots is far away from the trunk itself, and much better use of the decomposing organic matter can be made by the tree if such nutrients are adjacent to the feeding areas. Among the varieties of coffee tested for resistance to coffee *Fusarium* wilt, the "Murta" showed the highest tolerance to the disease. Other varieties, such as the "Ceylon Hybrid" and "Dewevrei," were somewhat tolerant, but not much more than the "Puerto Rico" and the "Columnaris". The latter variety is very promising. The noncommercial variety of coffee *Stenophylla*, has been reported tolerant to the malady in Dominica. Tolerant varieties could be planted in contaminated areas and could possibly be used for grafting.

It is well to remember that laboratory and greenhouse conditions are adjusted to create an adequate environment for the incidence of the disease and that all our experiments were conducted with coffee seedlings under one year of age. What may be the response of plants over one year of age and grown under field conditions is something else to consider. The variety "Columnaris" has been planted on several farms where coffee wilt is known to exist. So far, there have been no reports of the appearance of the malady on such plants. Further observations will demonstrate the good characteristics of this variety when grown under field conditions.

RESUMEN

Por el nombre de "podredumbre negra" es conocida en Puerto Rico una enfermedad de la raíz de los cafetos muy difundida en nuestras plantaciones e informada en otras islas del Caribe y países productores de café en Centro y Sud América. En Puerto Rico la enfermedad reviste gran importancia

económica, considerándosele un factor limitativo en el cultivo de este producto agrícola. Basta echar una ojeada a muchas de nuestras plantaciones para reconocer los graves perjuicios producidos.

La enfermedad se conoce en las Antillas desde el 1840 y a pesar de creerse al hongo *Rosellinia bunodes* (Berk. & Br.) Sacc., responsable de ella, no hay evidencia experimental que lo pueda constatar. En nuestra Isla se apunta también al *R. bunodes* como al posible agente causante de la podredumbre negra, sin que se haya demostrado categóricamente esa relación.

Ante esta situación creimos pertinente comprobar si el *R. bunodes* o igualmente otros organismos aislados de material infecto, tendrían que ver con la enfermedad. Ensayos de patogenicidad efectuados en la Universidad de Wisconsin durante el año escolar de 1938 al 1939 con el susodicho organismo y con una especie de *Verticillium*, demostraron que dentro de las condiciones de temperatura y humedad en que se hicieron las pruebas, el *R. bunodes* o igualmente el *Verticillium*, eran incapaces de producir, *independientemente* o conjuntamente, la podredumbre negra. Experimentos subsiguientes realizados en esta Estación durante los años comprendidos entre el 1939 y 1942, en condiciones variables de humedad y acidez del sustrato y dentro de un ambiente más o menos uniforme, ratificaron la incapacidad patogénica de los mencionados organismos.

El hecho de encontrar un gran número de cafetos con infecciones radicales con o sin mostrar los signos o síntomas característicos de la podredumbre negra, esto es, estriaciones vasculares oscuras; hizo pensar en la posibilidad de que fuese otro organismo, y no el *R. bunodes*, el responsable de la enfermedad y, que este organismo, al igual que otros aislados de material infecto, fuera únicamente uno de tantos saprófitos que toman incremento en cafetos enfermos.

En efecto, se encontró al hacer ensayos subsiguientes de patogenicidad, que entre los varios organismos aislados de cafetos enfermos, había uno del género *Fusarium*, capaz, por sí solo, de producir la enfermedad. Sin embargo, el leño de las plantas afectadas por este organismo no presenta los signos internos característicos de la podredumbre negra y atribuidos al *R. bunodes*. El *Fusarium* aislado pertenece a la sección *Elegans* y, de acuerdo con Sherbakoff, a quién se la envió para su clasificación; es morfológicamente idéntico al *F. bulbigenum*. Pudiendo ser una nueva raza o forma de esta especie se la denomina aquí para fines de identificación, como *F. bulbigenum* var. *coffae* var. nov. Su similitud con el *F. batatas* var. *Vanilla* Tucker es notable. Este último no ataca al café. El nuestro no ataca a la vainilla como hemos podido probarlo.

El organismo crece bien en un sinnúmero de sustratos nutritivos, especialmente en aquellos ricos en azúcar; como límites de crecimiento, temperaturas de 8 y 36 grados centígrados y con un optimum entre los 26

y los 28 grados centígrados. Puede crecer abundantemente en substratos con acidez entre los pH 2.19 y 8.5, aunque su mejor crecimiento es entre los pH 4.5 al 6.00. Las macrosporas son generalmente triseptadas, fluctuando en longitud entre 16.75 a 45 micras y en grosor entre 3.0 a 3.7 micras. Ocasionalmente se producen esporas de menor o mayor septación. Las microconidias son abundantes y por lo general sin tabiques.

Encontrándose que el organismo crecía bien en la disolución de Coon, formulada para este género de hongos, se utilizó dicha disolución para los ensayos de patogenia con plantas pequeñas de menos de un año de crecimiento. Primeramente se encontró que el hongo producía un producto metabólico, termolábil a 100°C., descartándose, consecuentemente, el filtrado de los cultivos al tiempo de prepararse el material inoculante a usarse para las pruebas. Al hacerse anteriormente pruebas de patogenia con los diversos organismos aislados, se notó que pocos eran los casos de infección cuando el patógeno se incorporaba en tierra esterilizada a vapor, siendo los resultados erráticos en muchas ocasiones. Para evitar las posibilidades de contaminaciones usando tierra, y asimismo otros factores de carácter fisicoquímico sobre los cuales no podíamos tener dominio alguno, fué que se decidió hacer todas las pruebas en un substrato de arena granítica, lavada, a la cual se la añadía la disolución de Coon de composición y acidez conocidas.

En efecto, se condujeron ensayos con plantas de café mostrando tres a cinco pares de hojas completamente formadas, inoculándolas según la técnica de Wellman (75). Dicha técnica consiste en la inmersión de las raíces de las plantas recién arrancadas de los semilleros en una suspensión de esporas y micelio del organismo en cuestión. En vista de que el patógeno produce una sustancia tóxica, se lavó el micelio y se hizo luego la suspensión en solución estéril de Coon. Las plantitas de café así inoculadas y sembradas inmediatamente en arena, saturada ésta con la disolución de Coon y revelando un pH de 5.53, mostraron síntomas característicos de la infección en un plazo de diez días.

El ambiente mantúvose cálido, fluctuando entre los 24° a los 36°C. y relativamente saturado por estar los cafetos inoculados bajo campanas de cristal.

Los síntomas se iniciaron con la aparición de una clorosis, siguiendo primeramente a lo largo de las nerviaciones de las hojas y luego distribuyéndose en forma de un moteado amarillo por el parénquima. Más tarde, las hojas se tornaron completamente amarillas, permaneciendo así algún tiempo, después del cual se ennegrecieron y secaron, cayéndose finalmente. En algunos tiestos de ensayo los cafetos infectados en vez de mostrar la clorosis descrita, se marchitaron. En condiciones de gran humedad relativa las plantitas mostraron síntomas de podredumbre del

tallo, estado conocido vulgarmente por "salcocho". El hongo en este ambiente húmedo crece profusamente sobre las partes infectas y asciende en muchos casos por los tallos hasta invadir los pecíolos de las hojas. Una particularidad notada entre los cafetos enfermos fué su lento desarrollo.

Un examen microscópico de las plantas afectadas mostró algunos vasos conductivos del xilema necróticos, un tanto hipertrofiados y, en otras ocasiones, llenos de una sustancia oscura. Cuando la infección está muy adelantada, la necrosis de los vasos se extiende hasta bien arriba del tallo. Las raíces muestran también un cuadro histológico similar. La corteza se deteriora: como se notó al arrancar las plantitas de los tiestos de arena. Las raíces y tallos mostrábanse desnudos de corteza.

Nuestros experimentos demostraron que en un sustrato completamente saturado de humedad, en todo tiempo las plantas se enfermaban menos que en uno en que la humedad fluctuaba entre el punto de saturación y grados relativamente secos, aunque sin llegar hasta el límite en que las plantas sufrieran por falta de agua.

Las temperaturas altas comprobaron ser importantes para la manifestación de la enfermedad. En las pruebas realizadas a temperaturas fluctuando entre los 24° y los 46°C.; el porcentaje de infecciones fué muy crecido. Asimismo se comprobó que a una temperatura sostenida de 24°C., las infecciones ocurrían frecuentemente.

Ensayos relacionados con la acidez del sustrato y su posible efecto en las infecciones demostraron que entre pH 4.53 y 6.50, el porcentaje de infecciones es altísimo, mientras que a pH mayores de 6.50 las plantas no manifestaron en ningún momento síntomas de infección. También pudo verificarse que cuando el pH del sustrato cambia en pocos días hacia un punto neutral o ligeramente alcalino, algunas plantas pueden recuperar de la enfermedad. Sosteniendo el pH siempre bastante ácido, el porcentaje de plantas enfermas es mucho más crecido.

Al hacerse varias pruebas sobre la propensión o posible tolerancia y resistencia de 28 variedades de café de los grupos Arabica, Robusta y Liberica, se encontró que unas eran más o menos propensas que la Puerto Rico. La variedad "Murta" demostró ser bastante tolerante a la enfermedad.

El estudio sobre esta relación de la acidez, entre otros factores, indica la posibilidad de aminorarse los casos de infecciones en los cafetales, ya neutralizándose la acidez de los terrenos dedicados a la siembra de cafetos o bien con el uso de algunas de las variedades que presentaron mayor grado de tolerancia a la enfermedad.

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THE CASHEW—A PROMISING SUPPORT FOR VANILLA

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The most widely used support tree in vanilla culture in Puerto Rico is the dwarf bucare (*Erythrina berteroana* Urban), which grows well under light natural shade and offers additional shade for the vanilla plant. However, when this tree is used in open sites where rainfall is scarce during a part of the year, as is the case in the western part of Puerto Rico (1) it has the disadvantage of shedding its leaves during the dry season, a time when the vanilla plant is in greatest need of protection from the direct rays of the sun.

Although the usual agronomic practice is to plant vanilla at the base of existing supports under natural shade, there is land available on open hill-sides in Puerto Rico which, with suitable shade, could be planted to vanilla. A tree that would serve as a support and at the same time provide adequate shade throughout the year would increase the areas available for growing this new crop.

The cashew (*Anacardium occidentale* L.) is a large spreading tree native to the American tropics and especially common in Brazil and the West Indies. This plant produces edible nuts rich in oil, and edible fruits high in vitamin "C." Because of its soft bark and constant shade, this tree was tested in the autumn of 1939 as a support for vanilla in comparison with bauhinia (*Bauhinia reticulata* DC.) and dwarf "bucare" (*Erythrina berteroana* Urban). A typical cashew tree as used in this test is shown in figure 1. On station property at Las Mesas, young seedlings were transplanted from pots to bench terraces constructed on a hillside having a western exposure entirely lacking additional shade or wind protection. Stands of bauhinia and dwarf bucare, both approximately 1½ to 2 years old, were already established under similar conditions on adjacent terraces.

Vanilla cuttings were planted under cashew in May 1941, when the trees were about 2 years old and 4 to 5 feet in height and had from 3 to 4 feet lateral spread of dense foliage. The planting under bauhinia was made approximately 4 months later, in September, while that under bucare had been made a year previously, in May 1940. Both of these support trees were about 4 years old, nevertheless, neither was so well developed as the cashew. Although the vanilla cuttings were planted at different periods, the data obtained in May 1943 pertaining to the vegetative growth of the vines showed a decided superiority in growth by the plants on cashew. These data are summarized in table 1.

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TABLE 1

Vegetative growth made to May 1943 by vanilla cuttings planted on open hillside terraces utilizing three different support trees

Support trees	Age of vanilla plants	Average stem growth per plant
	<i>months</i>	<i>feet</i>
Cashew	24	27.9
Bauhinia	18	6.3
Bucare	36	7.0



FIG. 1. Vanilla planted under a cashew tree about 4 years old. Note the good shade and framework of spreading branches well adapted to the training of vanilla vines.

The vines on cashew produced a large amount of vegetative growth per plant at the end of 2 years. The vines on the bucare produced only one-

fourth the amount of vegetative growth of those on the cashew at the end of 3 years. Those on the bauhinia produced a little over 6 feet but these vines were only 18 months old when the record was taken.



FIG. 2. Close-up of vanilla plant on cashew. Note the vigorous condition of the vine with its thick and long internodes and the various clusters of goodsized beans. Note also the fruit of the cashew. The upper portion is the apple while the lower is the nut or true seed.

The vines on the cashew were well developed, with thick, long internodes and large dark-green leaves, as shown in figure 2. The average diameter of the basal internode of these vines was 0.2 inch and of the uppermost well-developed internode 0.4 inch; which compared favorably with those of other plants grown under optimum shade conditions (2). The vines on the bauhinia and bucare supports were in poor condition characterized by short internodes and yellow-green leaves and were comparable to those of plants receiving excessive sunlight (2). To protect the lower part of the vines from

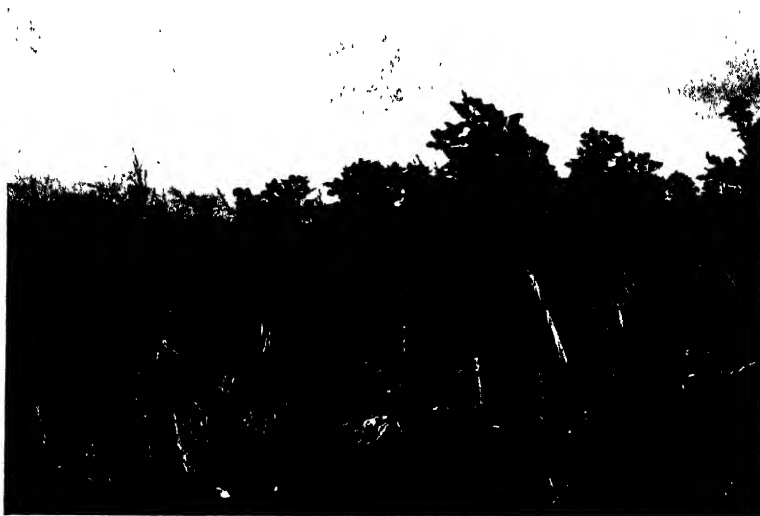


FIG. 3 Vanilla planted under bucare. Note the palm leaves necessary to protect the lower part of the vines from the direct rays of the sun.



FIG. 4. Vanilla vines planted under baubinia. Foliage at the beginning of the rainy season was light, thus making it necessary to use palm leaves to protect the vines from the excessive sunlight.

severe injury by the direct rays of the sun, it was necessary to use palm leaves as shown in figures 3 and 4. The cashew shown in figures 1 and 2,

did not shed its leaves and provided, without additional shade or wind protection, a continuous quantity of light which contributed to the healthy development of the vines.

The flowering and fruiting of vanilla on the bucare, for the first 2 years has been practically negligible, and no flowers have been produced by those vines growing on bauhinia. In the first year of flowering on the cashew, a crop of 11 pounds and 13 ounces of green beans was obtained from 22 plants.

SUMMARY

Cashew (*Anacardium occidentale*) was superior to bauhinia (*Bauhinia reticulata*) and bucare (*Erythrina berteroana*) as a support tree for vanilla when used on open hillside having a western exposure and without additional shade or wind protection. The vines on cashew produced more stem growth with long, thick internodes and dark-green leaves as compared to the short, thin internodes and yellow-green leaves of those grown on bauhinia and bucare. This was attributed to the inadequacy of the foliage of these supports to protect the vines and to the shedding of this foliage during the dry season, which further exposed the vines to intense sunlight.

The writer wishes to express his appreciation to Jacinto Rivera Pérez, collaborating agronomist, for assistance in gathering part of the data and photographs for this paper.

RESUMEN

El anacardo (*Anacardium occidentale*) resultó ser superior a la bauhinia (*Bauhinia reticulata*) y al bucare (*Erythrina berteroana*), como árbol de sostén de la vainilla, al ser utilizado en una ladera al raso que daba al oeste, desprovista de sombra y que no estaba protegida contra el viento. Las enredaderas bajo la protección del anacardo lograron mayor crecimiento de sus tallos, desarrollando largos y gruesos internodios y hojas verdinegras, mientras que las protegidas por la bauhinia o el bucare mostraban delgados internodios y hojas verdegay. Se atribuyó esto a lo inadecuado del follaje de estos árboles, para proteger debidamente a las enredaderas y, además, a que perdieron sus hojas en la temporada de sequía, lo cual las expuso a los rigores del sol.

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No. 2

USES, PREPARATION, AND PROPERTIES OF PINGUINAIN, THE PROTEIN-SPLITTING ENZYME OF THE MAYA FRUIT

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The existence of a protein-splitting enzyme in *maya* (*Bromelia pinguin* L.) was first established by Asenjo and Fernández in 1941 (1) and the name "pinguinain" suggested for this new enzyme. Pinguinain belongs to that group of enzymes known as papainases, that is, enzymes similar to papain which clots milk and digests proteins and live tissue. The milk-clotting activity of pinguinain is similar in many respects to that of the renin enzyme. Preliminary experiments carried out on it suggest its use as a substitute for this animal enzyme in the manufacture of cheese.

The above-mentioned properties of the papainases have already been put to practical usage both in industry and in medicine. Every year, beer manufacturers utilize a large amount of papainases in the preparation of "chill-proof" beers. When chilled, some beers become turbid because of small particles of protein and other associated substances that precipitate during the chilling process; when beers are pretreated with a proteainase (Wallerization), such as papain or pinguinain, such particles are digested and a perfectly clear beer is produced at low temperatures. Pinguinain

has already been tried by several consulting laboratories who report that it has proved very satisfactory for the above purpose.

The papainases are also abundantly used in the meat-packing industry, therefore another practical usage of pinguinain would be as a meat-tendering agent. Pinguinain has been found to soften meats readily and could compete favorably with papain and bromelin—the two enzymes now currently used as tenderizers—if produced on a commercial scale.

Many pounds of protein-splitting enzymes are used yearly in the tanning industry, since raw hides have to be treated with a proteinase to make them softer and more porous before being submitted to the action of the tanning reagent.

Lastly, the authors wish to call attention to the worm-digesting activity of pinguinain. Experiments have shown that *maya* juice, or the crude enzyme obtained from it, readily digests live intestinal parasites *in vitro* and *in vivo*, in experimental animals. For a long time now the juice of the *maya* fruit has been utilized as an anthelmintic in the folk medicine of the West Indies.

These potential applications of pinguinain in the practical field suggest the desirability of developing its production; so towards this end the Department of Agronomy of the Agricultural Experiment Station at Río Piedras, Puerto Rico, is studying the methods of planting and harvesting the *maya* fruit on a commercial scale.

In the present communication the authors report several observations dealing with the preparation and properties of pinguinain.

EXPERIMENTAL

The maya plant. This plant (Fig. 1) belongs to the pineapple family and has been described by Britton (2) as follows:

"*Bromelia pinguin* L.: Leaves many, tufted stiff, linear long-attenuate, 1-2 m. long, 2-4 cm. wide, light green, the margins armed with stout, rather distant hooked prickles 5-10 mm. long. Inflorescence paniculate, shorter than the leaves, stout, densely white-floccose; bractlets narrow, 5-25 mm. long; sepals narrow, erect, triangular-subulate; petals white or pinkish, about 3 cm. long, linear-elliptic, united below, the apex white-tomentose; stamens about 2 cm. long; anthers yellow, linear, 1-1.4 cm. long; ovary white-farinose, subterete. Berry ovoid, yellow, beaked, verruculose, 3-4 cm. long.

Thickets, hedges, and waste grounds, Porto Rico; St. Thomas, St. John, St. Croix:—West Indies and continental tropical America. Pifuela, Maya, Pinguin."

The plant is extensively utilized in the rural districts of Puerto Rico as a natural barrier or boundary. Attempts were made in the past to use its leaf fibers industrially.

The Maya fruit. The *maya* fruit grows in the center of the plant in the form of a bunch, as shown in Fig. 2, consisting generally of about 63 per cent fruit and the rest stalk. The fruit is available in appreciable amounts between May and November, but is difficult to obtain during the remainder of the year.

Two varieties of *maya* have been observed: a long, thin one that gives a poor yield of juice and a round, thick one, shown in Fig. 2, which yields a goodly amount. The first variety is found in sandy soils near the seashore,



FIG. 1. *Maya* plant with fruit stalk

while the latter grows in the interior of the Island at higher elevations. The authors have primarily utilized the last variety in their work.

Expression of the juice. The juice is prepared by squeezing the pulp in a cheesecloth as follows: the fruit is cut in four pieces; the pulp removed and pressed until dry of juice. The expressed juice is somewhat viscose but, left overnight in the icebox, the sludge settles to the bottom of the vessel and the supernatant fluid may be syphoned and used in the preparation of the enzyme. Attempts to centrifuge out the viscose sludge have proved unsuccessful; it may be removed only as described above, that is, by slow settling in the icebox. It is very important to remove this substance, which is primarily present in the rind of the fruit, before precipitating the enzyme; otherwise the latter is rendered sticky and difficult to dry. The author's

attempt to press the whole fruit produced an exceedingly viscose juice which could not be used in the preparation of the enzyme.

The pH of 10 different samples of *maya* juice fluctuated between 3.70 and 4.30 with an average of 3.75.



FIG. 2. Close view of fruit raceme

The activity of this juice varies somewhat. Such variation is recorded in table I for three different batches of juice in terms of milk-clotting units¹ and formol titrations (ml. 0.01N NaOH per ml. of juice).²

¹ The milk-clotting method of Ball and Hoover (3) was used throughout this work. Only 5 ml. of milk solution per tube were used hence, the milk-clotting units obtained were 0.546 times smaller than those resulting from the use of 10 ml. of milk.

² Throughout these studies, the technique utilized in formol titration was as follows: 2 per cent gelatin solution containing 1 per cent toluene, as preservative, was

Preservation of the juice. During the time that the authors have been working with *maya* juice, they observed that its activity diminished rapidly at room temperature, produced primarily by fermentation that set in from four to five hours after the juice was expressed. However, icebox temperatures of 4 to 8°C. preserved the juice for 24 to 48 hours without appreciable loss of activity, after which the activity again began to diminish rapidly.

TABLE I
Proteolytic activity of maya juice

Batch	Milk-clotting units per ml. of <i>maya</i> juice	Formol titration ml. 0.01N NaOH per ml. of <i>maya</i> juice
1	50.0	3.80
2	45.0	3.70
3	47.6	4.03
Average.....	47.5	3.84

TABLE II
Preservative action of different substances on the milk-clotting activity of maya juice at room temperature (25-28°C.)

No. of days standing at room temperature	Percentage of the original activity lost					
	Thymol 90 mg./100 ml	Sodium bisulphite 30 mg./100 ml.	Toluene 90 mg./100 ml.	50-50 toluene chloroform mixture 90 mg./100 ml.	Sodium benzoate 90 mg./100 ml.	Merthiolate 30 mg./100 ml.
1	25	38	46	33	52	4
2	50	52	55	54	65	4
6						4
12						4
29						46

Several reagents were tried as preservatives and their effect on the proteolytic activity of the juice was measured by means of the milk-clotting assay at different time intervals (Table II). Merthiolate (Sodium Ethyl Mercuri Thiosalicylate) was the only reagent that gave satisfactory results. Thirty milligrams kept 100 ml. of juice at room temperature for 12 days

used as a substrate. One ml. of the juice to be tested was then added to 10 ml. of this gelatin solution and one ml. samples taken for titration. The indicator was a solution containing 0.2 per cent phenolphthalein in 50 per cent alcohol. One ml. of 40 per cent formaldehyde was then added to each volume of mixture to be titrated; the strength of the sodium hydroxide solution was 0.01N. These tests were run for a period of 24 hours at an incubation temperature of 40°C.; no buffer was used. The natural pH of the mixture was found to be in the neighborhood of 4.5 to 5.

with only a slight loss of activity. However, after 29 days, the percentage loss of the original activity was 46 per cent. The authors used merthiolate at the above concentration all through the work to preserve juices and enzyme solutions which were kept for a few days with very good results.

TABLE III

Percentage yield of pulp, juice and enzyme preparation by weight of fresh fruit

Fruit batch no.	Percentage of pulp by weight of fresh fruit	Percentage of juice by weight of fresh fruit	Percentage enzyme yield by weight of fresh fruit
1	57.0	29.5	0.5
2	59.9	30.5	1.0
3	59.5	21.6	0.4
4	65.0	36.4	2.3
5	66.6	32.3	1.7
Average.....	61.6	30.1	1.1

TABLE IV

Proximate composition of crude pinguinain

Total moisture per cent.....	6.0
Reducing sugars per cent....	11.0
Nitrogen per cent.....	2.7
Substances soluble in ether per cent.....	1.1
Ash per cent.....	10.2

TABLE V

Milk-clotting activity of pinguinain

Batch No.	Milk-Clotting Units Per Gram
1	434.7
2	500.0
3	526.8
4	416.7
Average.....	469.5

Preparation of the enzyme. The crude enzyme was prepared by adding three volumes of acetone to one of juice, the precipitate obtained thereby separated by centrifugation, washed with fresh acetone and diethyl ether, and dried in a vacuum desiccator over CaCl_2 .³ The yield of enzyme for

³ In the original communication (1) the authors recommended dissolving this precipitate in 0.02 M NaCN and reprecipitating it with acetone. Later on they found that this step could be eliminated without affecting the quality of the final product.

several batches of fruit is recorded in Table II and averaged 1.1 gm. per 100 gm. of fruit, or 3.7 gm. per 100 gm. of juice.

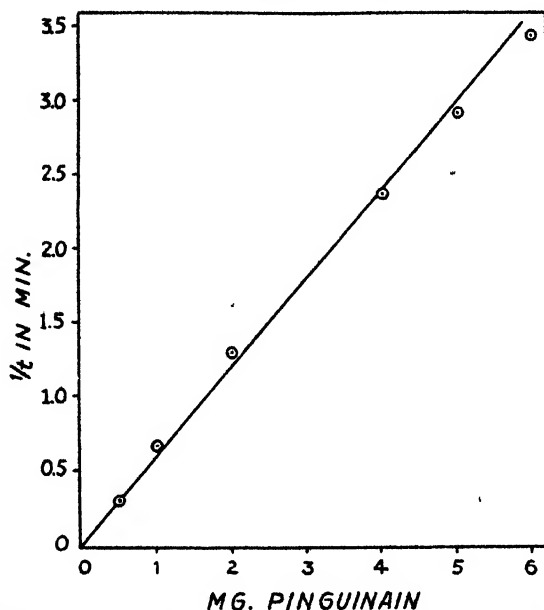


FIG. 3. Milk-clotting activity of pinguinain dissolved in 0.05 M NaCN

TABLE VI
Milk-clotting by pinguinain in 0.05M NaCN

Amount of Enzyme Per 6 ml. (E)	Time of Coagulation (t)	1/t	E.t - K
mg.	min.		
6.0	0.29	3.45	1.7
5.0	0.34	2.94	1.7
4.0	0.42	2.38	1.7
2.0	0.77	1.32	1.5
1.0	1.50	0.67	1.5
0.5	3.42	0.30	1.7
Average			1.6

General characteristics of the crude pinguinain. Generally, pinguinain has a very light greenish yellow color. It is an amorphous powder that dissolves somewhat slowly and produces an opalescent solution. This enzyme readily reduced Fehling's solution and gave a positive Millon's reaction for proteins. Its proximate composition is shown in Table IV.

Activity of pinguinain. The milk-clotting activity of four different batches of pinguinain are recorded in Table V, with an average activity of 469.5 milk-clotting units per gram.

The milk-clotting activity of various dilutions of pinguinain were determined by using 0.05M NaCN as diluent and the results obtained plotted in Fig. 3. The reciprocal of the milk-clotting time varied linearly between 0 and 6 mg. of enzyme. As in the case of crystalline chymotrypsin (3), apparently none of the enzyme was inactivated, as the curve passed through

TABLE VII

Digestion of casein in water by different amounts of pinguinain

Enzyme in 6 ml. digestion mixture	N. P. N. in 6 ml. digestion mixture 20 min. digestion
mg.	m.-eq.
10.0	0.330
5.0	0.249
1.0	0.044
0.5	0.032
0.1	0.014

TABLE VIII

Digestion of hemoglobin in urea at 40°C. by pinguinain dissolved in 0.05M NaCN

Enzyme in 6 ml. of digestion mixture	Tyrosine in 6 ml. digestion mixture after 10 minutes
mg.	m.-eq. $\times 10^3$
10.0	6.37
5.0	4.90
3.0	3.6
1.0	1.82
0.5	1.21
0.1	0.19

the origin; therefore, the simple equation $E \cdot t = K$ held for this range of dilutions.

This particular batch of pinguinain, when dissolved in 0.05M NaCN, had an activity of 606 milk-clotting units per gram, as computed from table VI.

The proteolytic activity of pinguinain on casein and hemoglobin was measured by the Northrop (5) and the Anson (6) methods, respectively; the results of these determinations are given in Tables VII and VIII.

The quantity of casein digested, in m.-eq., was plotted against the quantity of enzyme (Fig. 4); the variation was approximately linear up to 5 mg. of enzyme. From a straight line drawn tangent to the initial part of this

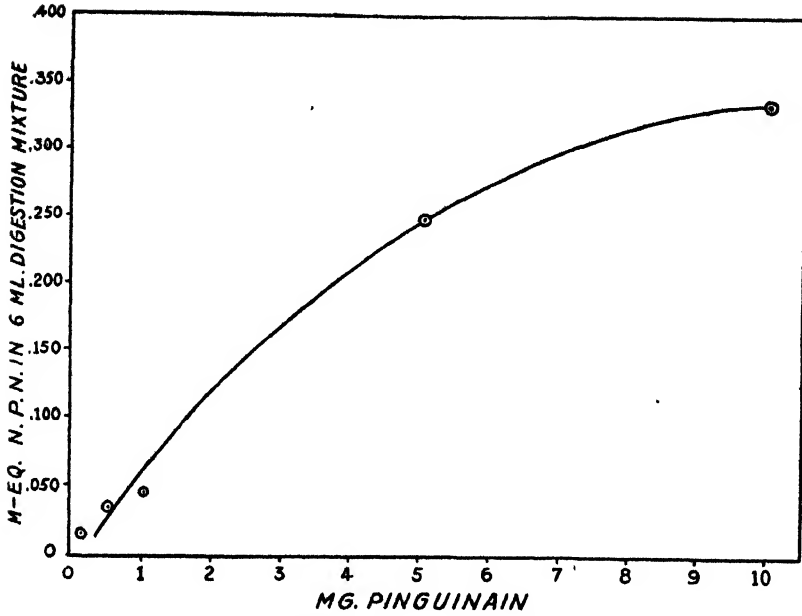


FIG. 4. Digestion of casein by pinguinain

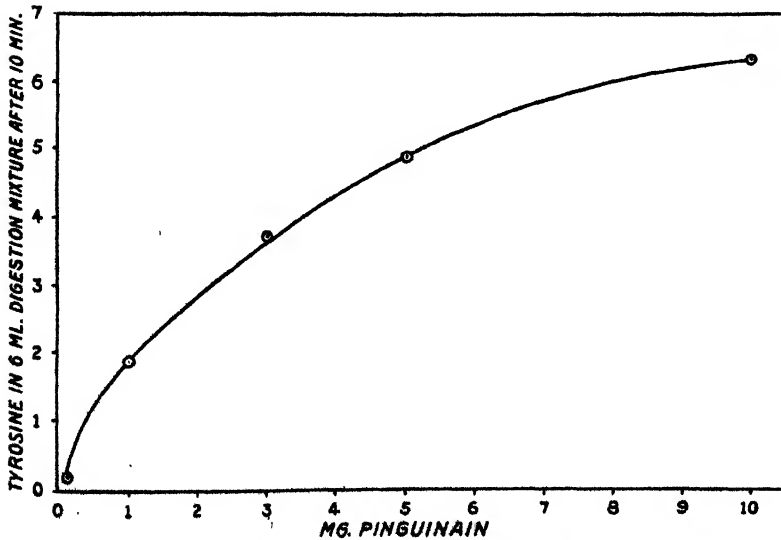


FIG. 5. Digestion of hemoglobin in urea by pinguinain dissolved in 0.05 M NaCN.
Tyrosine is in m-eq. $\times 10^3$

curve, the quantity of N. P. N. (non-protein nitrogen) in 6 ml. digestion mixture, yielded by 1 mg. of pinguinain, was found to be 0.055 m-eq. per mg. of the enzyme.

The proteolytic activity of pinguinain on hemoglobin was evaluated from a plot of tyrosine color against weight of enzyme. The pinguinain was dissolved in 0.05M NaCN to prevent its inactivation by the oxidative action of hemoglobin.

By drawing a line tangent to the first part of the curve, (Fig. 5) the Anson protease unit⁴ was calculated. It was found that 0.4 mg. of pinguinain gave a color value of 0.001 m.-eq. of tyrosine in 6 ml. digestion mixture after ten minutes. One Anson unit was, therefore, contained in $0.4 \times 1000 \times$

TABLE IX
Activation and inhibition of pinguinain

Reagents added to enzyme solution		Reciprocal of the milk-clotting time in min. 4 mg. enzyme	Ratio of activity to that of untreated enzyme
Inhibitor	Activator		
None*	None	1.560	1.00
0.00014M I ₂	None	0.189	0.12
0.00014M I ₂	0.2M NaCN	1.190	0.76
0.00028M I ₂	None	0.086	0.06
0.00028M I ₂	0.2M NaCN	1.062	0.68
0.00014M I ₂	None	0.183	0.12
0.00014M I ₂	0.3M cysteine HCl	1.390	0.89
0.00014M I ₂ and boiled	0.3M cysteine HCl	0.000	0.00
None	H ₂ S bubbled for 3 min.	2.130	1.36

* The untreated enzyme solution contained 4 mg. enzyme per ml. The pH of the untreated solution was 5.9.

10 = 4000 mg., or one gram of enzyme contained 0.25 Anson hemoglobin units.

Activation and inhibition of pinguinain. Pinguinain, like other papainases, responds readily to the activating action of some reducing agents and also to the inhibiting action of some oxidizing ones. Table IX records the action of some of these agents on the milk-clotting action of pinguinain.

Action of pinguinain on intestinal parasites. *Maya* juice, as well as the crude enzyme, readily digests intestinal parasites *in vitro* and *in vivo*. Dog *Ascaris* and *Macracanthorhynchus hirudinaceus* from hog intestines were incubated at 40°C. with *maya* juice and with a one per cent solution of pinguinain. These parasites showed definite signs of digestion in two

⁴ Anson defines one protease hemoglobin unit as the amount that will digest hemoglobin under standard conditions at an initial rate so that there is liberated per minute an amount of split products not precipitated by trichloroacetic acid which will give the same color with phenol reagent as one milliequivalent of tyrosine.

hours and were totally disintegrated in ten. Controls, in solution, inactivated by previous heating to 100°C., were not digested.



FIG. 6. *Ascaris* digested *in vivo* by pinguinain

TABLE X
Action of maya juice and pinguinain on dog ascaris in vivo

Dog No.	Dog Weight in kg	Dose Admini-tered	Egg Count		Number of partly digested ascarids in stools	Autopsy Findings
			Before Treatment	After Treatment		
1	2.3	10 gms Pin-guinain	19,972	3,233	5	No ascarids found in the intestine No ascarids found in the intestine
1	2.3	200 ml. maya juice	3,233	negative	1	
2	3.5	200 ml. maya juice	5,167	negative	4	

Animal experiments were carried out on dogs infected with *Ascaris*. On administering both the juice and the enzyme, by the use of stomach tube, the ascarids were expelled in the feces in a partially digested condition (Fig. 6). The details of this experiment are reported in Table X.

Both the fresh *maya* juice and the pinguinain in the dosages given above readily digest dog *Ascaris in vivo*.

SUMMARY

Some of the uses, methods of preparation, and properties of pinguinain, the protein-splitting enzyme of the *maya* fruit, have been considered and studied herein.

RESUMEN

La pinguinaina es un enzimo proteolítico del grupo de las papainasas, la cual se haya en el zumo de la fruta de la maya (*Bromelia pinguin* L.). En el presente artículo se describen sus posibles usos medicamentosos e industriales y se estudia su preparación, conservación y acción proteolítica sobre varios substratos.

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EFFECT OF LIME AND PHOSPHORUS ON THE YIELD OF FOUR LEGUMINOSAE IN TWO ACID SOILS OF PUERTO RICO

By J. A. BONNET, E. A. TELFORD, F. MARIOTA AND P. TIRADO SULSONA¹

INTRODUCTION

Conservation of soil nitrogen and organic matter is of paramount importance in the tropics. Although some Leguminosae grow well in the acid soils of the humid region of Puerto Rico it is believed that maximum yields of green manuring and maximum nitrogen fixation have not been obtained, in Puerto Rico, because little attention has been given to some practices which have a direct bearing on optimum growth of these plants. Among these practices, the application of lime to acid soils and the application of phosphorus to soils deficient in it are of importance.

EXPERIMENTAL WORK

Two one-acre fields of the soil type "Fajardo clay", at the Experiment Station farm in Río Piedras; and two of the soil type "Catalina clay" level phase, at "Las Ochenta" farm in Mayaguez, were chosen for the site of the experiment. Two fields were chosen at each place to study also the effect on the crop yield of sweet potatoes of two methods of incorporating the green manure. In field "A", the green manure was turned-under with a hoe as done by small farmers. In field "B", it was plowed under with a tractor-driven plow as done by the large landowners.

"Fajardo clay" is an acid soil of the humid region derived from old, high alluvial material and from outwash fans of adjacent shale hills. The relief is level or gently sloping. In a cultivated field it has a granular-brown or reddish-brown, friable, clay surface about 9 inches thick, fairly easily penetrated by plant roots and percolating water. The upper few inches of the subsoil consists of distinctly heavier, mottled, deep-red and brown, medium-compact clay, which slightly hinders the percolation of water and interferes with good development of roots. At a depth of about 14 inches, the soil material becomes mottled gray, yellow, and red, acid clay, having about the same physical characteristics as the layer above. The material continues to a depth of more than 5 feet and becomes slightly less compact with depth, but is distinctly mottled. Small angular fragments of shale, some of which are in different stages of weathering, are scattered over the surface and throughout the soil in various quantities.

¹ Respectively, Head Dept. of Soils, Assoc. Soil Conservationist, and two Jr. Soil Conservationists. This work was undertaken in cooperation with the Soil Conservation Service of Puerto Rico, of which Mr. E. A. Telford is Associate Soil Conservationist, and the Federal Experiment Station at Mayaguez.

"Catalina clay" is one of the most extensive all-round farming soils in the humid uplands. The relief ranges from rolling to steep, but most of the hills are rounded and gently sloping ravines intervene. It is an acid soil, lateritic, derived from andesitic tuff and tuffaceous shale. A cultivated soil ranges in color from red to light brown. Few of the large fields are uniform in color, because deep plowing and sheet erosion have exposed the red subsoil that lies below the original brown or reddish-brown surface soil, and the result is a heterogeneous color. Normally, the surface soil is a light reddish-brown, friable, softly granular clay that forms large clods when plowed; but which soon slakes into fine granules after the first or second dashing tropical shower. The thickness of the surface soil, as well as the value of the land, varies with the relief. On the less valuable, steeper, more eroded slopes, the surface soil does not average more than 4 inches in thickness,

TABLE 1
Distances of planting of the leguminous crops

Crops	Leguminosae	Between rows	Between plants
			<i>inches</i>
First	Velvet beans	3 feet	18
	Crotalaria	14 inches	Continuous
	Cowpeas	3 feet	4
	Soybeans	2.5 feet	4
Second	Velvet beans	1 foot	6
	Crotalaria	1 foot	Continuous
	Cowpeas	1 foot	4
	Soybeans	1 foot	4

and when the land is plowed some of the subsoil is exposed. On the more rolling, more valuable, less eroded areas, the surface soil is generally about 8 inches thick. The upper part of the subsoil, ranging from a depth of 8 to 24 inches, is brownish-red or red heavy, but friable, slightly-granular clay. Both the surface soil and the subsoil are penetrated readily by plant roots and percolating water; and as a consequence, sheet erosion is less severe than on soils with more plastic subsoil, which absorb water more slowly. The lower part of the subsoil, beginning at a depth of about 24 inches, is a dark-red clay that is more friable than the material in the layers above. The uniform red clay continues to a depth ranging from 10 to 30 feet, before the parent rock is reached. Areas of "Catalina clay" in which the relief ranges from nearly level to slightly undulating, are classified as "Catalina clay", level phase. It has not been affected by sheet erosion, and the normal soil-forming processes have been acting unmolested on it for a long time.

TABLE 2
Dates of planting and harvesting and age of crops

Crops	Location	Leguminosae	Date of planting	Date of harvesting	Age
			<i>1944</i>	<i>1944</i>	<i>days</i>
First	Río Piedras	Velvet beans	June 21	Sept. 6	77
		Crotalaria	8	Aug. 14	67
		Cowpeas	26	3	38
		Soybeans	21	16	56
Second	Río Piedras	Velvet beans	Oct. 6	Dec. 7	62
		Crotalaria	26	11	46
		Cowpeas	16	6	51
		Soybeans	20	5	46
First	Mayaguez	Velvet beans	May 29	Sept. 5	103
		Crotalaria	30	Aug. 4	66
		Cowpeas	29	July 18	50
		Soybeans	30	26	57
Second	Mayaguez	Velvet beans	Sept. 21	Nov. 23	63
		Crotalaria	Oct. 16	poor growth	
		Cowpeas	Sept. 26	Nov. 20	55
		Soybeans	Oct. 9	Nov. 21	43

TABLE 3
Yields per acre of two consecutive crops of leguminosae in the absence or presence of lime and phosphoric acid

Treatment	Río Piedras				Mayaguez			
	Field "A"		Field "B"		Field "A"		Field "B"	
	First crop	Second crop	First crop	Second crop	First crop	Second crop	First crop	Second crop
	<i>green weight</i>				<i>green weight</i>			
	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>
Velvet beans	93.1	89.6	126.9	111.4	94.8	63.0	54.2	34.7
Velvet beans with lime & P ₂ O ₅	125.6	113.3	135.3	133.0	126.3	98.9	86.8	60.8
Crotalaria	33.0	6.8	84.4	10.1	29.1		6.5	
Crotalaria with lime & P ₂ O ₅	41.3	10.3	117.3	7.4	31.2		6.1	
Cowpeas	96.2	97.0	69.9	92.3	81.7	60.7	51.9	24.4
Cowpeas with lime & P ₂ O ₅	96.0	106.2	94.8	122.8	89.3	72.1	67.5	30.3
Soybeans	16.6	25.1	38.9	30.7	43.2	22.4	22.6	12.6
Soybeans with lime & P ₂ O ₅	24.9	40.2	53.9	48.7	88.0	35.6	41.5	16.4
	<i>dry weight</i>				<i>dry weight</i>			
	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>	<i>cwt.</i>
Velvet beans	20.4	18.2	27.0	22.2	17.2	12.6	12.7	9.1
Velvet beans with lime & P ₂ O ₅	26.8	22.9	28.5	24.6	22.4	19.9	19.4	16.2
Crotalaria	4.7	1.2	11.9	1.6	5.0		1.5	
Crotalaria with lime & P ₂ O ₅	5.9	2.3	16.2	1.2	5.3		1.4	
Cowpeas	9.4	13.4	7.1	13.0	12.3	10.7	9.2	5.4
Cowpeas with lime & P ₂ O ₅	9.7	14.9	9.3	17.1	13.5	13.1	12.2	6.8
Soybeans	2.4	4.5	5.2	5.8	9.1	5.1	6.1	3.7
Soybeans with lime & P ₂ O ₅	3.8	7.4	7.6	9.2	18.7	8.5	9.8	5.1

TABLE 4

Mean dry-weight yields per acre of all crops in Rio Piedras and Mayaguez, excluding Crotalaria

Leguminosae	Treatment	General
	<i>cwt.</i>	<i>cwt.</i>
Velvet beans, no lime & phosphorus.....	17.42	
Velvet beans lime & phosphorus.....	22.58	
Velvet beans.....		20.00
Cowpeas no lime & phosphorus.....	10.05	
Cowpeas, lime & phosphorus.....	12.07	
Cowpeas.....		11.06
Soybeans, no lime & phosphorus.....	5.25	
Soybeans, lime & phosphorus.....	8.76	
Soybeans.....		7.01

Values to be exceeded for significance by difference between means of:

Treatments	General
At 5% point; $1.967 \sqrt{\frac{2 \times 20.42}{72}} = 1.48$	$1.967 \sqrt{\frac{2 \times 20.42}{144}} = 1.05$
At 1% point; $2.590 \sqrt{\frac{2 \times 20.42}{72}} = 1.95$	$2.590 \sqrt{\frac{2 \times 20.42}{144}} = 1.38$

TABLE 5

Mean dry-weight yields per acre of all crops in Rio Piedras

Leguminosae	Treatment	General
	<i>cwt.</i>	<i>cwt.</i>
Velvet beans, no lime & phosphorus.....	22.10	
Velvet beans, lime & phosphorus.....	25.54	
Velvet beans.....		23.82
Cowpeas, no lime & phosphorus.....	11.86	
Cowpeas, lime & phosphorus.....	11.59	
Cowpeas.....		11.73
Soybeans, no lime & phosphorus.....	4.53	
Soybeans, lime & phosphorus.....	6.96	
Soybeans.....		5.74
Crotalaria, no lime & phosphorus.....	3.53	
Crotalaria, lime and phosphorus.....	7.74	
Crotalaria.....		5.63

Values to be exceeded for significance by difference between means of:

Treatments	General
At 5% point; $1.971 \sqrt{\frac{2 \times 2.75}{36}} = 0.77$	$1.971 \sqrt{\frac{2 \times 2.75}{72}} = 0.54$
At 1% point; $2.599 \sqrt{\frac{2 \times 2.75}{36}} = 1.02$	$2.599 \sqrt{\frac{2 \times 2.75}{72}} = 0.72$

It differs from the typical soil, in that it has a thicker surface soil and a slightly more compact, lower subsoil layers; causing slightly restricted in-

TABLE 6

Analysis of the total sum of squared deviations, of the dry-weight for all crops of Leguminosae at Rio Piedras and Mayaguez, excluding the Crotalaria

Source	Degrees of freedom	Sum of squares	Variance	F
Zone.....	1	499.66	499.66	16.14*
Field.....	1	117.19	117.19	3.79
Zone x Field.....	1	910.02	910.02	29.40*
Crop.....	1	177.36	177.36	5.73*
Crop x Field.....	1	.45	.45	
Crop x Zone.....	1	732.16	732.16	
Crop x Zone x Field.....	1	.53	.53	
Error (a).....	64	1980.64	30.95	
Treatments.....	5	14276.68	2855.34	39.83*
Species.....	2	12731.07	636.55	31.17*
Fertilizer.....	1	1368.89	1368.89	67.04*
Species x Fertilizer.....	2	176.72	88.36	3.05
Treatment x Field.....	5	131.72	26.34	
Species x Field.....	2	72.63	36.31	
Fertilizer x Field.....	1	9.54	9.54	
Species x Fertilizer Field.....	2	49.55	24.78	
Treatments x Crop.....	5	497.91	99.58	4.88*
Species x Crop.....	2	473.77	236.88	11.60*
Fertilizer x Crop.....	1	.50	.50	
Species x Fertilizer x Crop.....	2	23.64	11.82	
Treatments x Crop x Field.....	5	22.00	4.40	
Species x Crop x Field.....	2	13.07	6.54	
Fertilizer x Crop x Field.....	1	1.01	1.01	
Species x Fertilizer x Crop x Field.....	2	7.92	3.96	
Total SS.....	431	26288.50		
		-19346.32		
Error (b).....	340	6942.18	20.42	

* Significant at the 1% point.

ternal drainage which is reflected by the mottled gray, reddish-brown, and red coloring of the normally red lower subsoil layer.

Each one of the four experimental fields was divided into 72 plots, three with plots having an approximate area of one-hundredth acre; and one at Mayaguez, with plots having an approximate area of one-hundred twentieth

acre. Half of the plots in each field received limestone at the rate of four tons per acre, and superphosphate at the rate of one-hundred pounds P_2O_5 per acre. Velvet beans *Stizolobium deeringianum*; crotalaria *Crotalaria striata*; cowpeas *Vigna sinensis*; and soybeans *Soja max*, Ootootan variety;

TABLE 7

Analysis of the total sum of squared deviations of the dry-weight data for all four crops of Leguminosae at Rio Piedras

Source	Degrees of freedom	Sum of squares	Variance	F
Field.....	1	431.69	431.69	17.04†
Crop ..	1	76.06	76.06	3.00
Crop x Field.....	1	109.51	109.51	4.32*
Error (a).....	32	811.02	25.34	
Treatments ..	7	16270.61	2324.37	845.22†
Species ..	3	15786.11	5262.04	1754.00†
Fertilizer ..	1	438.08	438.08	146.00
Species x Fertilizer ..	3	46.42	15.47	5.63†
Treatment x Field ..	7	292.01	41.72	15.17†
Species x Field ..	3	206.47	68.82	25.03†
Fertilizer x Field ..	1	0.00		
Species x Fertilizer x Field ..	3	85.54	28.51	10.37†
Treatment x Crop ..	7	2049.87	292.84	106.49†
Species x Crop.....	3	2005.91	668.64	243.14†
Fertilizer x Crop ..	1	0.00		
Species x Fertilizer x Crop.....	3	43.96	14.65	
Treatment x Crop x Field	7	2786.21	398.03	144.74†
Species x Crop x Field ..	3	2619.80	873.27	317.55†
Fertilizer x Crop x Field ..	1	110.23	110.23	40.08†
Species x Fertilizer x Crop x Field	3	56.18	18.73	6.81†
Total SS.	287	23,442.18		
		-22,826.98		
Error (b).....	224	615.20	2.75	

* Significant at the 5% point.

† Significant at the 1% point.

were selected for the Leguminosae. The seeds of soybeans at Río Piedras were inoculated with commercial Nitragin culture. All the other seeds were inoculated by the soil-paste or muddy-water method. Each treatment was replicated nine times.

Two consecutive crops of each one of the Leguminosae, planted at convenient distances (table 1) were harvested from each field (table 2). The

first crops, except the velvet beans, were harvested at the prebloom period. The second crops were harvested at approximately the same dates.

Green-weight and dry-weight yields, for each one of the two crops of Leguminosae at Río Piedras and Mayaguez, are reported in table 3. Mean dryweight yields of all crops in Río Piedras and Mayaguez, excluding the crotalaria because of its poor growth in Mayaguez, are reported in table 4. Mean dry-weight yields of all crops in Río Piedras are reported in table 5.

Tables 6 and 7 contain, respectively, the analysis of the total sum of squared deviations of the mean dry weights.

MAJOR RESULTS

In general, the combined experiments at Río Piedras and Mayaguez, excluding the crotalaria (tables 4, 6) indicate that:

1—The mean dry-matter yield of velvet beans in the presence or absence of the lime and phosphorus application or as a whole, was significantly higher at the 1 per cent point, than that of cowpeas and soybeans; whereas that of cowpeas was higher than that of soybeans.

2—The mean dry-matter yield of velvet beans with lime and phosphorus, was significantly higher at the 1 per cent point, than that of velvet beans without lime and phosphorus. The same applies to soybeans, and cowpeas.

In general, the combined experiments at Río Piedras, including the crotalaria (tables 5, 7) indicate that:

1—The mean dry-matter yield of velvet beans in the presence or absence of lime and phosphorus application or as a whole, was significantly higher at the 1 per cent point, than that of cowpeas, soybeans, and crotalaria; whereas that of cowpeas was higher than that of soybeans, and crotalaria. The soybeans was significantly higher at the 5 per cent point, than the crotalaria, in the absence of lime and phosphorus, and significantly lower in their presence; but as a whole there was no significant mean difference between them.

2—The velvet beans, soybeans, and crotalaria, responded significantly at the 1 per cent point, to the application of lime and phosphorus. The cowpeas showed no response to the fertilizer.

SUMMARY

The effect of lime and phosphorus on the yields of velvet beans, crotalaria, cowpeas, and soybeans, is presented for eight crops harvested in the acid soil types Fajardo Clay and Catalina Clay, of Puerto Rico.

Data for distances of plantings, age of crops, green and dry-weight yields for each of two consecutive crops of the leguminosae in each of four fields, and for the mean dry-weight yields of all crops are presented. Analysis for the total sum of squared deviations of the dry weight for the various crops, is also presented and discussed.

Velvet beans, the highest yielder, gave, in the absence or presence of lime and phosphorus, mean green weights of 83.5 and 110.0 hundredweights per acre, respectively, equivalent to mean dry weights of 17.4 and 22.6 hundred weights per acre.

RESUMEN

Se expone aquí el efecto de la cal y el fósforo en relación con el rendimiento de las habichuelas "terciopelo", crotalarias, fréjoles y habas sojas de ocho cosechas, producidas en los tipos de suelos ácidos "Fajardo arcilloso" y "Catalina arcilloso" de Puerto Rico.

Se hace una exposición sobre la distancia de siembra, edad de las cosechas, rendimientos de dos cosechas consecutivas a base de peso verde y peso seco de las leguminosas de cada una de las cuatro fincas, así como del promedio de peso seco de todas las cosechas. Se expone y discute también el análisis de la suma total de las desviaciones cuadráticas del peso de las diversas cosechas a base de peso seco.

Las habichuelas "terciopelo", que fueron las que dieron mayor rendimiento, produjeron, en ausencia o presencia de la cal y el fósforo, un promedio de peso verde de 83.5 y 110.0 quintales por acre, respectivamente; equivalente a un promedio de peso seco de 17.4 y 22.6 quintales por acre.



FIG. 1. General view of the legume plots as laid out on the contour at Mayaguez



FIG. 2. Two adjacent soybean plots at Mayaguez. The plot at the left received lime and phosphorus



FIG. 3. Plot in foreground is one of velvet beans with lime and phosphorus, at Río Piedras



FIG. 4. General view of field at Río Piedras. *Crotalaria* without lime and phosphorus in foreground and center. Velvet beans with lime and phosphorus in-between

FUNGI OF THE DOMINICAN REPUBLIC—XYLARIACEA

By JULIAN H. MILLER¹

The Xylariaceae of the Dominican Republic are relatively little known, and in Ciferri's list (2), only thirteen species are reported. In Puerto Rico and the Virgin Islands, Seaver and Chardón (4), report fifty-three species from a much smaller territory. Our unsatisfactory knowledge of the Dominican Xylariaceae is due to the fact that previous mycological explorers showed little or no interest in collecting saprophytic forms, confining themselves almost exclusively to plant parasites.

M. J. Berkeley (1) in 1852, reported the following species:

1. *Hypoxyton concentricum* Berk

Now *Daldinia concentrica* (Bolt. ex Fr.) Ces. & De Not.

2. *Hypoxyton comosum* Berk

Now *Xylaria comosa* (Berk.) Mont.

3. *Hypoxyton domingensis* Berk

Now *Xylaria domingensis* (Berk.) Sacc.

4. *Hypoxyton grammicum* Berk

Now *Xylaria grammica* (Berk.) Mont.

5. *Hypoxyton obtusissima* Berk

Now *Xylaria obtusissima* (Berk.) Sacc.

Feé (3) in 1835, was the first to report a species of this group from Santo Domingo, describing *Sphaeria divaricata*, which is now called *Xylaria divaricata* (Feé) Sacc.

R. A. Toro (5), in 1927, reported six additional species, one of which, *Daldinia concentrica*, had already been collected. The rest of them were:

6. *Kretzschmaria rugosa* Earle

7. *Nummularia Bulliardii* Tul

8. *Xylaria apiculata* Cooke

9. *Xylaria arbuscula* Sacc

10. *Xylaria consociata* Starb

With regards to Toro's collections, the following comments are pertinent: *Kretzschmaria rugosa* is a synonym of *Xylaria anisopleura*, *Nummularia Bulliardii* apparently does not occur in the tropics, and *Xylaria apiculata* is not in America. His number 315, reported as *Xylaria consociata*, has been examined and found to be *Xyl. Hypoxyton*; and his number 320, reported as *Xylaria apiculata*, has been included under the present study and found to be *Xyl. multiplex*.

In view of the above confusing records, and the fact that Berkeley's collection has not been examined, it is difficult to determine the number

¹ Department of Plant Pathology, University of Georgia.

of valid species known from the flora. Provisionally, this may be figured at 9, that is Berkeley, 5; Feé, 1; and Toro, 3.

The present study of the Xylariaceae of the Dominican Republic has been based on collections made by Dr. Carlos E. Chardón, during the summer of 1937. It contains twenty-four species, none of which were previously reported, and are consequently new to the flora. Duplicates of all specimens have been kept by the writer.

Hypoxyton Bull., Champ. Fr. 1: 168. 1791.

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Grev., Scott. Crypt. Fl. 6: 324. 1828.

Sphacria maxima Hall

Hist. Stirp. Helv. 3: 122. 1768.

Sph. deusta Hoffm

Veg. Crypt. 1: 3. 1787.

Sph. versipellis Tode

Fung. Meckl. Sel. fasc. 2: 55. 1791.

Hyp. ustulatum Bull

Champ. Fr. 1: 176. 1791.

Sph. deusta Hoffm ex Fr

Syst. Myc. 2: 345. 1823.

Hyp. ustulatum Bull ex Fr

Summa Veg. Scand. p. 383. 1849.

Ustulina vulgaris Tul

Sel. Fung. Carp. 2: 23. 1863.

Ust. deusta (Hoffm ex Fr)

Petrak, Ann. Myc. 19: 279. 1921.

Nemania maxima (Hall) House

N. Y. State Mus. Rep. 266: 48. 1925.

A closely related form, *Ustulina zonata* (Lev.) Sacc., is usually considered distinct due to wider and more rounded spores, but the writer does not think the difference is sufficient to warrant a specific distinction. This form, rather than *Hyp. deustum*, is the usual one in the tropics.

On dead wood.

La Vega: Forests at El Hatillo, Chardón 1092, August 28, 1937.

2. **Hypoxyton fossulatum** Mont

Crypt. Guyan., Ann. Sci. Nat. IV, 3: 123. 1855.

Nummularia fossulata (Mont) Cke

Grev. 11: 127. 1883.

This is an interesting fungus in that it is an annulate form, closely related to *Hyp. Stygium* (Lev.) Sacc., but is constantly smooth, not show-

ing the perithecial elevations. The asco-spores are $6-8 \times 2.5\mu$. The type is Leprieur 692 from Cayenne, but the writer has specimens from Trinidad and Puerto Rico as well as many other countries.

On dead wood.

La Vega: Ravine near Jarabacoa, 550 m., Chardón 949, Aug. 5, 1937.

3. *Hypoxylon glomeratum* Cke

Grev. 11: 134. 1883.

Hyp. Mascariensis Berk ex Cke

Grev. 11: 131. 1883. Non Mont.

Hyp. anthracoderma Speg

Fung. Guar. Pug. 3: 28. 1888.

Hyp. Berkeleyi Sacc

Syll. Fung. 9: 551. 1891.

Hyp. Bakcri Earle

Bull. Torr. Bot. Club 26: 633. 1899.

Hyp. vinosa-purpureum Ell & Ev

Fl. Lud. Nom. nud.

Hyp. cohaerens Pers ex Fr var. *brasiliensis* Starb

Ascom. Reg. Exp. 2: 8. 1901.

Hyp. rubigineo-areolatum Rehm var. *microspora* Theiss

Ann. Myc. 6: 345. 1908.

Hyp. Merrillii Syd

Ann. Myc. 15: 212. 1917.

Hyp. cupricolor Petch

Ann. Roy. Gard. Peradeniya 8: 158. 1924.

Hyp. rubigineo-areolatum Rehm var. *Bakeri* (Earle) Mill

Mycol. Explor. Colombia, Jour. Dept. Agri. P. R. 14: 273. 1930.

This species is widely spread over both North and South America.

On dead wood.

La Vega: Trail from Maimón to Yuna River, Chardon 1028, Aug. 13, 1937;
Forest at El Hatillo, Chardón 1086 & 1095, Aug. 28, 1937.

4. *Hypoxylon sclerophaeum* Berk & Curt

Exot. Fung. Schw., Jour. Acad. Nat. Sci. Phila. 2nd. ser. 2: 285.
1853.

? *Sphaeria coelata* Fr

Linnaea 5: 540. 1830.

Hyp. placentiforme Berk & Curt

Cuban F., Jour. Linn. Soc. 10: 383. 1869.

Hyp. Wrightii Berk & Curt

l. c. 1869

Hyp. coelatum Ces

Fung. Born. Atta. Acc. Sci. fisch e matim. d Napoli 8: 19. 1879.

Nummularia Wrightii (Berk & Curt) Sacc

Syll. F. 1: 398. 1882.

Numm. suborbicularis (Berk & Curt) Sacc var. *Cookeana* Sacc

Syll. Fung. 1: 399. 1882.

Numm. placentiformis (Berk & Curt) Sacc

Syll. Fung. 1: 399. 1882.

Hyp. nicaraguense Ell & Ev

Iowa Univ. Bull. 2: 394-415. 1893.

Penzigia polyporus Starb

Ascom. der Schwed. Chaco-Cordill. Exped. p. 32, Ark. fur Bot.
5. 1905.

Daldinia placentiformis (Berk & Curt) Theiss

Ann. Myc. 7: 4. 1909.

Numm. Cookeana (Sacc)

Rehm, Ascom. Phil. Leaf. Bot. 6: 2273. 1914.

Pyrenopolyporus Hunteri Lloyd

Myc. Notes 49: 705, f. 1054. 1917.

Hyp. amorphum Ell & Ev

Nom. nud. Kew herb.

Hypodiscus placentiformis (Berk & Curt)

Rick, Broteria ser. Bot. 25: 34. 1931.

On fence posts.

La Vega: Maimón River, near Maimón, Chardón 1017, Aug. 13, 1937

5. *Hypoxylon serpens* Pers ex Fr

Summa Veg. Scand. p. 384. 1849.

Sphaeria macula Tode

Fung. Meckl. 2: 33. 1791.

Sph. serpens Pers

Syn. Meth. F. p. 20. 1801.

Sph. uda Pers

Syn. Meth. F. p. 33. 1801.

Sph. colliculosa Schw

Syn. Car no. 82. 1822

Sph. serpens Pers ex Fr

Syst. Myc. 2: 341. 1823.

? *Sph. unita* Fr

Elench. Fung. 2: 67. 1828.

Sph. caries Schw

Trans. Amer. Phil. Soc., Phila. n. ser. 4: 194. 1832.

- Hyp. bipapillatum* Berk & Curt
Exot. Fung. Schw., Journ. Phila. Acad. Sci. II, 2: 285. 1853.
- Sph. capnodes* Berk & Br
Hooker Lond. Jour. 4: 72. 1845.
- Hyp. colliculosum* (Schw) Curt
Geol. & Nat. Hist. Surv. N. C., pt. III, p. 140. 1867.
- Hyp. unitum* (Fr) Nits
Pyren. Germ. p. 44. 1867.
- Hyp. aeneum* Nits
Pyren. Germ. p. 47. 1867.
- Hyp. effusum* Nits
Pyren. Germ. p. 48. 1867.
- Hyp. reticulatum* Karst
Not ur Sallsk. pro Fauna et Fl. Fenn. II, p. 238. 1871-74.
- Hyp. allantoideum* Cke
Grev. 8: 66. 1879.
- Hyp. caries* (Schw) Sacc
Syll. Fung. 1: 393. 1882.
- Anthostoma capnodes* (Berk & Br) Sacc
Syll. Fung. 1: 298. 1882.
- Hyp. ramosum* Schw ex Cke
Grev. 11: 132. 1883.
- Hyp. irregulare* Cke
Grev. 11: 133. 1883.
- Ustulina linearis* Rehm
Hedw. 33: 310. 1892.

This species has the same general appearance as the mature stage of *Hyp. glomeratum*. The distinction lies in the spore measurements. The ascospores of the former are usually between 10 and 15 μ . long, while those of the latter are from 9 to 11 μ . Also in the early stages *Hyp. serpens* is dirty white, easily distinguishing it from *Hyp. glomeratum* which is a bright red.

Hyp. serpens is world wide in distribution, but is rarely found in the tropics.

On dead wood.

La Vega: Forests at El Hatillo, Chardón 1090 Aug. 28, 1937.

6. *Hypoxylon Stygium* (Lev) Sacc
Syll. Fung. 1: 379. 1882.
- Sphaeria Stygia* Lev
Ann. Sci. Nat. 5: 258. 1846.
- Hyp. Puiggarii* Speg

Fung. Puigg. Pug. I., Bol. Acad. Cien. Cordoba II, n. 257. 1889.
Hyp. annuliforme Rehm

Verh. bot. Brand. p. 65. 1890.

Hyp. platystomum Ell & Ev

N. Amer. Pyr. p. 649. 1892.

Hyp. microcarpum Penz & Sacc

Malphigia 11: 492. 1897.

Hyp. Bogariense v. Höhn

Stzb. K. Akad. d. Wiss. Wien. 118, abt. I, p. 341. 1909.

Hyp. punctatum Petch

Ann. Roy. Bot. Gard, Peradeniya 8: 153. 1924.

The number 763 shows very prominent perithecia, while in number 1022 the stroma is plane as in forms previously placed in *Nummularia*.

The type was collected from St. Domingue by Poiteau, and is in the herbarium of the Museum of Paris. No. 1022 is similar to the type.

On dead branches of tree.

Azua: Las Caobas ravine, south of San José de Ocoa, Chardón 763, July 10, 1937.

La Vega: Trail from Maimón to Yuna River, Chardón 1022, Aug. 13, 1937.

7. *Hypoxyylon tinctor* (Berk) Cke

Grev. 11: 135. 1883.

?*Sphaeria clypeus* Schw

Syn. Car. n. 42. 1822.

Sph. tinctor Berk

Hook. Lond. Journ. Bot. 4: 311. 1845.

Hyp. clypeus Schw ex Curt

Geol. & Nat. Hist. Surv. N. C. III, p. 140. 1867.

Diatrype clypeus Schw ex Berk

Grev. 4: 95. 1876.

Diatrype tinctor (Berk) Sacc

Syll. Fung. 1: 200. 1882.

Hyp. applanatum Cke

In herb. Kew. Nom. nud.

Nummularia clypeus Schw ex Cke

Grev. 12: 6. 1883. Excl. Cke. Spec.

Numm. tinctor (Berk.) Ell & Ev

N. Amer. Pyr. p. 627. 1892.

Many specimens of this species, especially from the tropics, do not exhibit the discolored substratum, but No. 627 shows this orange color in just as marked a manner as in specimens from the southern United States.

On dead wood and dead trunk of *Ficus nitida* (No. 627)

Azua: River forest, near San Juan de la Maguana, *Chardón 627*, June 27, 1927; Public Square, San José de Ocoa, *Chardón 761*, July 9, 1937.

Kretzschmaria Fries, *Summa Veg. Scand.* p. 409. 1849.

8. **Kretzschmaria cetrarioides** (Curr & Welw)

Sacc., *Syll. Fung.* 9: 966. 1891.

Hypoxyylon cetrarioides Curr & Welw

Trans. Linn. Soc. 26: 282. 1869.

Sphaeria lichenoides Berk

Kew herb. Nom. nud.

Rhopalopsis lichenoides (Berk) Cke

Grev. 11: 94. 1883.

Kretz. lichenoides (Berk) Sacc

Syll. F. 2: Add. ad vol. 1, XXIX. 1883.

Rhopalopsis cetrarioides (Curr & Welw) Cke

Grev. 11: 127. 1883.

Kretz. lichenoides Rick

Ann. Myc. 7: 8. 1909.

On dead wood.

La Vega: Forests road to Cotui, *Chardón 1077*, August 6, 1937.

9. **Kretzschmaria clavus** Fr.

Summa Veg. Scand. p. 409. 1849.

On dead wood.

La Vega: Ravine, km. 67, road to Bonao, *Chardón 800*, July 18, 1937; Forests road to Cotui, *Chardón 1077*, Aug. 6, 1937; Forests at El Hatillo, *Chardón 1091, 1093*, Aug. 28, 1937.

Nummularia Tul., *Fung. Carp.* 2: 42. 1863.

10. **Nummularia artocreas** (Cke & Mass)

comb. nov.

?*Hypoxyylon labellum* Mont

Ann. Sci. Nat. IV, 3: 511, t. 5, fig. 5. 1855.

?*Camillea labellum* Mont

Syll. Crypt. p. 208. 1856.

Diatrype artocreas Cke & Mass

Grev. 21: 4. 1892.

Numm. repanda Fr var. *zonata* Ell & Ev

Iowa Univ. Bull. 2: 394-415. 1893.

Nummularoidea artocreas (Cke & Mass) Lloyd

Myc. Notes 7: 1281, f. 2872. 1924.

Camillea artocreas (Cke & Mass) Rick

Broteria ser. bot. v. XXV, fasc. 1, p. 38. 1931.

Lloyd, l.c. fig. 2871, shows a photograph of *Cam. labellum*, and in fig. 2872, one of *Numm. artocreas*. These are the types and are identical in structure, but the Montagne specimen is sterile while the type of *Numm. artocreas* has ascospores $12-15 \times 5\mu$.

This fungus looks much like *Numm. repanda* (Fr.) Nits., but it is distinct in the presence of much finer ostiola and in the sharply fusoid ascospores. Also, the latter are very faint yellow even in old specimens, but in *Numm. repanda* they are dark brown.

This is the common *Nummularia* in the West Indies and in South America. The type is from St. Vincent (B. W. I.). The writer has specimens from Puerto Rico, Jamaica, Nicaragua and Costa Rica.

On dead wood.

La Vega: Forests road to Cotui, Chardón 961, August 6, 1937.

Penzigia Sacc. Myc. Malac. p. 20. 1888.

11. **Penzigia frustulosa** (Berk & Curt) Mill

Myc. Explor. Ven. Univ. P. R. Monogr. ser. B, No. 2: 211. 1934.

Hypoxylon frustulosum Berk & Curt

Cuban F., Jour. Linn. Soc. 10: 383. 1869.

Hyp. leucocreas Berk & Rav

Grev. 4: 51. 1875.

Hyp. microsporum Ces

Myc. Born. Atta. Acc. Sci. fisich. e Matim. di Napoli 8: 17. 1879.

Nummularia frustulosa (Berk & Curt)

Syll. F. 1: 398. 1882.

Hyp. exiguum Cke

Grev. 11: 130. 1883.

Xylaria frustulosa (Berk & Curt) Cke

Grev. 12: 5. 1883.

Hyp. lilliputianum Syd

Ann. Myc. 8: 37. 1910.

Penzigia microspora Petch

Ann. Roy. Bot. Gard. Peradeniya 10: 137. 1924.

On dead trunk of tree.

Trujillo: Thickets beyond Bani, Chardón 592, June 26, 1937.

Poronia Gledits. Willd. Fl. Berol. p. 400. 1787.

12. **Poronia oedipus** Mont

Syll. Crypt. p. 209. 1856.

Sphaeria (Poronia) punctata var. *oedipoda* Mont

Ann. Sci. Nat. II, 13: n. 35. 1841.

Sph. incrassata Jungh

Flor. Javae Crypt. p. 87. 1838.

Hyp. oedipus Mont

Cuban Fl. p. 346, t. 13, f. 2. 1838-1842.

Poronia macropoda var. *cladonioides* Ces

In Klotz.-Rab. Herb. Myc. no. 1946.

On horse dung.

Santiago: San José de las Matas, *Chardón 462*, June 6, 1937.

Xylaria Hill., Hist. Pl. p. 72. 1773.

13. *Xylaria arbuscula* Sacc

Michelia 1: 249. 1878.

On decaying pod of *Hymenaea courbaril* L.

La Vega: Forests at El Hatillo, *Chardón 1215*, August 28, 1937.

14. *Xylaria axifera* Mont

Ann. Sci. Nat. IV, 3: 106. 1855.

On dead wood.

La Vega: Forests at El Hatillo, *Chardón 1098*, August 28, 1937.

15. *Xylaria bulbosa* (Pers ex Fr) Berk & Br

Berk. Out. Brit. Fung. p. 385. 1860.

Sphaeria bulbosa Pers

Obs. Myc. 2: 63. 1799.

Sph. bulbosa Pers ex Fr

Syst. Myc. 2: 327. 1823.

Sph. corniformis Fr

Elench. Fung. 2: 57. 1828.

Xylaria corniformis Fr

Summa Veg. Scand. p. 381. 1849.

This species has been named *Xylaria corniformis* in most North American herbaria. It is black, rugose, without a pellicle and sometimes there is a sterile tip. When growing on a hard substrate there is a bulbous base. The only other species with similar appearance and small spores (8-10 x 4-5 μ .) is *Xylaria castorea* Berk., but it differs in being compressed instead of terete.

On dead wood.

La Vega: Forests near Yuna River, El Hatillo, *Chardón 1032*, August 14, 1937; Forests at El Hatillo, *Chardón 1103, 1106*, August 28, 1937.

16. *Xylaria Chardoniana* (Toro) Mill

Mycol. Expl. Ven. Univ. P. R. Monogr. ser. B., no. 2: 214. 1934.

Poronia Chardoniana Toro

N. Y. Acad. Sci. Surv. P. R. 8: 68. 1926.

Heretofore known only from Puerto Rico and Venezuela.

On horse dung.

Santiago: San José de las Matas, *Chardón 456*, June 6, 1937.

17. *Xylaria cristata* Speg

Fung. Argent. 1: 179. 1880.

On decaying log.

Samaná: Cacao plantations, Sabana de la Mar, *Chardón 730*, July 5, 1937.

La Vega: Forests at El Hatillo, *Chardón 1101*, Aug. 28, 1937.

18. *Xylaria cubensis* Mont

Syll. Crypt. p. 202. 1856.

Hypoxyton cubensis Mont

Ann. Sci. Nat. II, 13: cent. 2, no. 29. 1840.

Hyp. cubensis Mont

Sagra Fl. de Cuba, p. 347, t. 13, f. 1. 1842.

Xylaria fusca Lloyd

Myc. Writ. 5: 770, f. 1155, 1156. 1918.

This species is clavate, smooth, fuscous to darker, terete, with small spores, 8-10 x 4-5 μ . It is common in South America, the West Indies, and in the southern United States.

On decaying trunk of tree.

Samaná: Cacao plantations, Sabana de la Mar, *Chardón 740*, July 6, 1937.

19. *Xylaria Hypoxyton* (L ex Fr) Grev

Fl. Edin. p. 355. 1824.

Clavaria Hypoxyton L

Sp. Pl. p. 1182. 1753.

Sphaeria Hypoxyton L ex Fr

Syst. Myc. 2: 327. 1823.

On dead wood.

Trujillo: San Cristobal, *Kern & Toro 315*, Mar. 13, 1937 (reported as *Xylaria consociata* Starb.).

Samaná: Cacao plantations, above Samaná, *Chardón 741*, July 6, 1937.

La Vega: Forests at El Hatillo, *Chardón 1100 & 1102*, Aug. 28, 1937.

Puerto Plata: Forests near Sosúa beach, *Chardón 903*, Aug. 1, 1937.

On dead leaf sheaths of *Roystonea quisqueyana* Bailey.

La Vega: Outskirts of Bonao, *Chardón 899*, July 31, 1937.

Duarte: Near San Francisco de Macoris, *Chardón 1075*, July 18, 1937.

20. *Xylaria inaequalis* Berk & Curt

Jour. Linn. Soc. 10: 382. 1868.

The surface of the fertile portion is dark brown, and at maturity splits in anastomosing lines in a manner similar to *Xyl. multiplex*, *Xyl. arbuscula* and *Xyl. apiculata*. The spores are 9–11 x 4–5 μ . as in *Xyl. multiplex*. It differs in possessing very slender stromata and prominent perithecial elevations.

On decaying trunks.

Samaná: Cacao plantations, Sabana de la Mar, Chardón 732 & 734, July 5, 1937.

La Vega: Ravine near Jarabacoa, 550 m., Chardón 951, Aug. 5, 1937; Forests at El Hatillo, Chardón 1083, Aug. 28, 1937.

On decaying log of *Hura crepitans* L.

Duarte: Road beyond San Francisco de Macoris, Chardón 806, July 18, 1937.

21. *Xylaria multiplex* (Kze ex Fr) Berk & Curt

Jour. Linn. Soc. 10: 381. 1869.

Sphaeria multiplex Kze ex Fr

Linnaea 5: 536. 1830.

On dead and decaying wood.

Trujillo: San Cristobal, Kern & Toro 320, Mar. 10, 1926 (reported as *Xylaria apiculata* Cke.).

Samaná: Cacao plantations, Sabana de la Mar, Chardón 731, 733 & 979, July 5, 1937.

La Vega: Ravine, km. 67, road to Bonao, Chardón & Toro 921, July 18, 1937; Forests at El Hatillo, Chardón 1097, 1104, 1107, 1221, Aug. 28, 1937.

22. *Xylaria muscula* Lloyd

Myc. Writ. 6: 994, pl. 160, f. 1780. 1920.

On dead wood.

La Vega: Forests at El Hatillo, Chardón 1216, Aug. 28, 1937.

23. *Xylaria scruposa* (Fr) Berk

Jour. Linn. Soc. 10: 382. 1869.

Sphaeria scruposa Fr

Elench. Fung. 2: 55. 1828.

Hypoxyton scruposum (Fr) Mont

Cuban F. p. 350. 1838–1842.

On dead wood.

La Vega: Trail from Maimón to Yuna River, Chardón 1027, Aug. 13, 1937; Forests at El Hatillo, Chardón 1105, Aug. 28, 1937; La Trinchera, near El Hatillo, Chardón 1232, Oct. 31, 1937.

24. *Xylaria tabacina* (Kickx) Berk

Hooker's Jour. Bot. & Kew Misc. 6: 225. 1854.

Hypoxyton tabacinum Kickx

Bull. Acad. Brux. 8: 11. 1841.

On decaying log.

La Vega: Ravine, km. 67, road to Bonao, Chardón & Toro 803, July 18, 1937.

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A SURVEY OF THE FOREST INSECTS OF PUERTO RICO

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A SURVEY OF THE FOREST INSECTS OF PUERTO RICO*

PART I

(An Annotated List of the Insects Affecting Forest, Shade and Ornamental Trees in Puerto Rico.)

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INTRODUCTION

Tropical Forest Entomology is a science in its embryo stage in the American tropics. Very little investigation has been conducted in tropical America and yet so much needs to be done. Undoubtedly, research in Forest Entomology will develop parallel to the investigations in the scientific development of tropical forest resources.

During the last decade, Forestry has been playing a very important role in the agricultural development of Puerto Rico. New forest units have been added to the existing forest areas, hundreds of thousands of trees have been planted, new forest management and research methods have been used, all tending towards a main objective: the successful development of insular forest resources.

The U. S. Forest Service, the Insular Forest Service, and the Tropical Forest Experiment Station are the institutions that will be responsible for the future development of our forests. These organizations working in co-ordination are trying to solve the existing problems hindering the expansion of forestry in the Island.

One of the main problems with which the foresters deal is the forest insects. These small but highly destructive creatures are the cause of serious depredations in tropical forests, all the more serious because so little is known about them. Gundlach, Wolcott, DeLeón, Seín, are among the scientists which have contributed to the knowledge of our forest fauna.

The writer has been making observations on forest insects since 1934. During 1940, this work was proposed as a special off-campus research project under the approval of the Graduate School of the Ohio State University and the supervision of Dr. Dwight M. DeLong, Professor of Entomology in that institution. This survey is thus the result of almost eight years of observations, the greater part of the work being done during the last two years, at which time the writer devoted his spare time, week ends and holidays to the field work.

* This dissertation with minor changes and additions was presented in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Graduate School of the Ohio State University, in June 1943.

The survey is admittedly far from complete, but is intended to include all available information concerning the insects affecting forest, shade and ornamental trees of Puerto Rico.

The work consists of two parts, the first of which is an annotated list of the insects affecting the trees. The host trees are mentioned by their scientific names in alphabetical order, and the insects are listed under each tree. Directly under the name of each tree, the family to which it belongs is cited, followed by notes on distribution, uses or economic importance and common names of the tree species. Then the insects are listed or recorded, following more or less this sequence: insects affecting the flowers, fruits or seeds, leaves, twigs, branches, trunk and roots. Often species attacking the decayed wood or resting on the tree will be mentioned at the end of each tree discussed.

The second part is a discussion of the most important insects affecting the trees. Whenever possible the following information will be given about each insect species: general distribution of the insect; description of the adults, eggs, larval or nymphal and pupal stages; habits, natural enemies, artificial control and host trees attacked.

In the arrangement of the Orders and Families of the Insecta, the writer follows Wolcott's, "Insectae Borinquenses", with a few minor changes, and the work of Britton & Wilson, "Botany of Porto Rico and the Virgin Islands.—Descriptive Flora—Spermatophyta", (with a few changes) for the botanical terminology. Only those insects directly affecting the trees will be discussed, the parasitic or predatory forms will be only mentioned and few of the most important briefly discussed. Those insect forms which occur in trees, but whose role is unknown, will be mentioned in the first part of the work, but will not be discussed in the second. Some of these include predatory insects, others living in decayed wood, or acting as scavengers, etc. In many instances one will find in "Insectae Borinquenses" insects recorded as: "resting on the tree", "on a leaf", "on a branch", "in flowers", etc., without stating specifically what the insect was doing on the tree or host plant. Such records have been omitted in this work.

For the references cited most often, the initials EEWI, standing for "Economic Entomology of the West Indies", will be used; IP, for "Insectae Portoricensis", IB, for "Insectae Borinquenses", and SIB, for "Supplement to Insectae Borinquenses". In the references to authors, the name, year of publication and in most cases the page number will be given. The complete reference will be included in the Bibliography. The initials LFM and GNW will denote Luis F. Martorell and George N. Wolcott respectively.

Many of the records were taken from "Insectae Borinquenses" or from

its Supplement. Even if the record has been already published in the Supplement, but the collection and observations were made by the writer, the initials (LFM.) will follow those of the references.

It has been the aim of the writer in making this Survey to serve a dual purpose:

(1) As a help for foresters and men interested in Forestry and its allied branches, in which it could be used as a guide or manual to the forest insects of our Island.

(2) To serve as a basis for future investigations in Forest Entomology, not only in Puerto Rico, but in the West Indies and tropical America.

ORIGIN OF OUR INSECT FAUNA

Many authoritative biogeographers have studied and discussed in detail the distribution of the fauna and flora of the West Indies. Nearly all come to the definite conclusion that the Antillean fauna is purely South and Central American in origin. In some insect groups this thesis is very clearly seen and supported by means of the comparison of our actual living species. In others there are blank pages, questions to be answered and problems to be solved, before an attempt is made to unveil the mysteries of the past.

Before going further, it seems desirable to give a short review of the geologic history of Puerto Rico.

According to Meyerhoff (1933) the geologic eras known as the Archeozoic, Proterozoic and Paleozoic combined account for eighty-five percent of all geologic history.

"It is surprising to discover that nearly all the rocks comprising the Greater Antilles were formed within the last twelve percent of geologic time. Archeozoic, Proterozoic and Paleozoic rocks play so small a part in the Island's visible framework that their very existence is debatable. But the conviction that the history of the Antillean region dates back into the past is deep-rooted, and attempts are constantly being made to lift the veil that enshrouds its beginnings." (Meyerhoff 1933, p. 25.)

The geology of Puerto Rico is intimately related with that of the other islands of the Greater Antilles and all seems to share the same geologic changes since the beginning of Antillea. As far as geologists know, the history of Puerto Rico began during the middle of the Cretaceous period, in which the Island was what can be called a boiling cauldron, that is, in the midst of volcanic eruptions. From that time up to the Recent period the geological events can be summarized as shown in the accompanying tabular outline.

A controversy exists among geologists as to the existence of land bridges between Central America and the Antilles in early geologic ages. Meyer-

hoff does not believe in the presence of land bridges connecting the Antilles with Central or South America. His conclusions are based purely on geological facts. On the other side Schuchert (1935) is an ardent supporter of the land bridge theory. Most biogeographers favor the theory of land

TABULAR OUTLINE OF THE PHYSIOGRAPHIC HISTORY OF PUERTO RICO AND THE VIRGIN ISLANDS. (After Meyerhoff 1927, p. 560)

RECENT	Slight emergence	
	Maximum submergence	
<hr/>		
	BLOCK FAULTING	
	Partial submergence east of P. R., with migratory stand line during glacial stages.	
PLEISTOCENE	Uplift, with warping, followed by youthful to mature dissection of Caguana peneplane.	
<hr/>		
	Uplift, followed by extensive peneplanation of costal plain and oldland (Caguana peneplane).	
PLIOCENE	Uplift, followed by extensive peneplanation (upper, or St. John, peneplane).	
MIOCENE	Upper	
	Middle	
	Lower	Costal plain accumulation
OLIGOCENE	Upper	
	Middle	
	Lower	Partial peneplanation (lower pene-peneplane, or subcostal-plain erosional surface).
<hr/>		
EOCENE	Record not preserved, but probabilities of earlier cycles of erosion strong.	
PALEOCENE	Intrusion, folding, uplift, making complex mountainous oldland.	
<hr/>		
UPPER CRETACEOUS	Accumulation of andesitic volcanics and sediments.	

bridges, basing their beliefs on the homogeneity of the Antillean fauna and flora and its close resemblance to that of Central and South America.

What are the factors contributing to the distribution of life on the different lands of the world? The dispersal of organisms has been possible through the agency of winds, storms, ocean currents, rivers, floods, and even by the seasonal migration of birds and other animals.

Many noted biogeographers have discussed the probable means of the distribution of life on the globe. Mathew (1930) does not believe in land

bridges but in the fortuitous introduction and emigration of mammals, reptiles and invertebrates. He lists the means of such emigrations as windblown, by the action of hurricanes, sea storms, floods of inland rivers bringing from the interior of islands and continents huge masses of vegetation containing flora and fauna, and these masses or rafts floating and being driven thousands of miles away by oceanic currents. Mathew's work should be read by all students interested in biological sciences, especially on the distribution of animal life in the present and past.

Guppy (1917) also has the same theories as Mathew on the fauna and flora and its subsequent distribution through the islands and continents of the world.

Pilsbry (1930) is in support of the Central-Antillean bridge. In discussing the land snails of the Caribbean he comes to the conclusion that they are of purely South and Central American origin. He says, "Of North American genera, few occur in the West Indies. With Central America there are many more genera in common, and these are largely of South American affiliation; these migrants have come by three distinct routes: (1) the oldest, by the northeastern extension of Honduras-Nicaragua towards Jamaica; (2) by a similar approximation to Yucatán peninsula and the west end of Cuba (3) the youngest, by way of Trinidad, Tobago and the Lesser Antilles."

C. T. Simpson (1894) believes that the snail fauna has been scattered in the Antilles by means of (1) land bridges (2) and water drifting.

Petrunkévitch (1928-29) on the other hand gives great importance to the air currents as a natural means of migration and distribution of the spider fauna of the Greater Antilles. He also accepts the fact that the spider fauna of the Greater Antilles (Puerto Rico included) originated from land migrations from Central America.

Writing about the spider fauna of the Lesser Antilles he says, "There are two distinct faunas, that of the Greater Antilles and that of the Lesser Antilles. The former represents the eastern outgrowth of the Central American fauna presumably by way of an earlier land connection. The fauna of the Lesser Antilles has South America and particularly Venezuela for its origin and developed along the path of the air-currents, especially of the hurricanes. In Porto Rico we find the last traces of this fauna, admixed to the fauna which came from the west. Species characteristic of certain islands and not found anywhere else, wherever chance importation is reasonably excluded, may be regarded as having originated on the respective islands and therefore indicative of the evolutionary trend of such isolated faunas."

Barbour (1916) in discussion of Mathew's theories writes: "Now I do not believe, with Mathew, that the Antilles are oceanic islands—lands

which have received their fauna by fortuitous transportal. My reasons for thinking as I do are these: first, I believe that the islands of the Antillean chain have too evenly distributed and homogeneous a fauna for it all to have been fortuitously derived; secondly, I consider the fauna to be composed of too many different animal phyla; and thirdly I believe that many of these elements are not of a nature to have withstood "flotasm or jetasm" dispersal. We must now consider Mathew's exposition of the natural raft hypothesis (page 37 et seq.). He states: "Natural rafts have been several times reported as seen over a hundred miles off the mouths of the great tropical rivers such as the Ganges, Amazon, Congo and Orinoco. For one such raft observed, a hundred has probably drifted out that far unseen or unrecorded before breaking up." This is obvious and undoubted. But, and this is important, these rafts, even the very large ones, float low in the water; they soon become soaked with salt water in a calm sea, rippled over or broken over if the sea be choppy or rough as it is in the trade wind or monsoon belts. Only organisms or their eggs which are encapsulated or otherwise naturally resistant can withstand these conditions." (Barbour 1916, p. 153.)

"Let us consider for a moment the Antillean chain as a whole; it is utterly impossible that ocean currents could now or in the past have brought rafts with equal frequency to all parts of this island arc, and yet the same types reappear upon island after island all the way from Cuba to Grenada. Rafting from island to island certainly could not have occurred, since there never have been large rivers on them had they always retained their present size. The fauna is far larger in number of species upon the Greater Antilles than upon the Lesser, as the conditions favorable for the survival of species are obviously better upon the large islands with their luxuriant vegetation than upon such barren islets as, for example, Sombrero or Redonda. The types, however, which have been able to survive upon Sombrero or Saba are just those which are found, along with many others, upon Cuba or Haiti. In my "Herpetology of Jamaica" and "Zoogeography of West Indian Reptiles," I have gone into this matter in detail and there is no need of repeating what has been said there. This homogeneity of the fauna is the best possible proof that winds (tornados, hurricanes, etc.), birds, small floating drift, etc., have played no considerable part in populating the island by carrying eggs or adults, since it is inconceivable that by these means the same improbable choice of passengers would be carried to so many islands." (Barbour 1916, p. 156-7.)

More and more cases could be cited of distinguished students of the interesting problem facing the facts about the distribution of animal and plant life in the Antilles. All of them, with a few exceptions, seem to believe in the existence of land bridges or connections between Central

America and the Antilles. Most of them deny any connection of the Greater Antilles with the Lesser, but, in reference to the latter, there is a chance that they were connected with some part of northern Venezuela sometime during the geologic history of Antillea. If they were not really connected the proximity of these islands to the South American mainland was such that part of the fauna and flora could easily have access to them.

The student interested in the different geologic phases of Puerto Rico, especially in reference to its connection with the rest of the Antilles should consult the maps at the end of Schucherts's book (1935).

According to previous studies, scientists have come to the following conclusions: That Jamaica was the first section of Antillea to become insular, then was followed by Cuba. Puerto Rico and Hispaniola retained their connections for a very long time, until finally they were divided in two, and lastly Puerto Rico was separated from the Virgin Islands.

All the above discussion about the distribution of life in the Antilles, has been based on faunistic studies on reptiles, mammals, crustaceans, molluscans, etc. Very little has been said about insects, which is our main point of interest.

Fossil molluscans, foraminiferans, plants, mammals, etc., have been collected in Puerto Rico but as far as I know not a single insect fossil has been recorded from the Island. Thus it would be difficult to give definite statements about the origin of our insect fauna, altho theories have been advanced concerning the possible origin of the Lepidopteran and Homopteran fauna of the Antilles, some with special reference to Puerto Rico.

Osborn (1932) in a discussion of the geographic and ecologic factors in the distribution of the neotropical Homoptera is puzzled by the poverty of the Puerto Rican homopterous fauna, as compared with the other islands of the Greater Antilles, South and Central America. In discussing the different families of the group, he gives special emphasis to the scarcity of representatives of the families Cicadidae, Membracidae and Cercopidae in Puerto Rico.

Forbes (1930) in discussing the origin of the Puerto Rican insect fauna, says: "Geologically the island of Porto Rico is one of the newer units of area of the earth's surface, being, so far as we know now, probably not quite as old as the order Lepidoptera itself. . . . In the late Miocene the island was again raised, and was presumably connected to neighboring islands, producing a condition where migration may have been relatively free from island to island in the West Indies and also from Central America; if, indeed, the islands had been separated at all before the Pliocene (?) faulting. In the Pliocene this region was again partially submerged, leaving only a fringe of the limestones of Oligocene to late Tertiary age above water. Finally after several oscillations of sea-level during the glacial epochs, the

present level was reached. There is no evidence that during any part of the time after its first emergence Porto Rico was ever wholly under water; but for a time, in the Oligocene and Miocene, it must have had only about half of its present area, and for a time in the late Tertiary it must have been part of a much larger land mass." In another paragraph he continues: "During the Oligocene time of reduced area there is no reason to believe that any substantial addition was made to the fauna of Porto Rico, or even to that of the Greater Antilles as a whole, but with the later Tertiary emergence room was provided for a much more extensive fauna, and no doubt a large part of our now characteristic Antillean fauna arrived at that time. There are three possible sources for these newcomers: The United States, Mexico (or rather Yucatán and Honduras), and South America via the Lesser Antilles."

Bates (1935), arguing about the Antillean butterfly fauna, considers the island of Hispaniola as a center of dispersal for the butterflies in the Antilles.

Comparing the homogeneity of the Antillean butterfly fauna with reference to North, South and Central America, Bates presents a chart showing such similarities. The original chart does not include the butterfly fauna of Puerto Rico, but the chart on the next page, amplified by addition of Puerto Rican fauna and others for North America, gives data not included by Bates in his original chart (see chart I).

It would be difficult to try to prepare a similar chart for different groups of families in the other orders of the Insecta, since the fauna of such islands as Jamaica, Hispaniola and perhaps Cuba has not been completely studied in detail. It is very fortunate that the butterflies of the Antilles have been so well studied as to establish the comparison.

Puerto Rico's position in respect to the other islands of the Greater and Lesser Antilles is most remote: farthest east of the Large islands (with the exception of the small group of the Virgin Islands) and farthest north of the group of the Lesser Antilles. Thus, if during past ages there were land migrations from Central and South America, undoubtedly our Island was the last to get the benefit of such migrations. The writer believes that Puerto Rico acquired its present fauna by the following ways:

- (1) Land migrations from other islands of the Greater Antilles, South and Central America by the early land connections of the main land with Antillea.

- (2) By the migratory habits of certain species of insects, such as the butterflies and moths.

- (3) By the activities of man: particularly the early natives living in those islands, long before the coming of white men; by the early settlers themselves.

CHART I
Antillean Fauna

	Puerto Rico	Cuba	Hispaniola	Jamaica	Central America	South America	North America
1. <i>Pieris</i>	X	X	X	X	X	X	X
2. <i>Appias (Tachyris)</i>	X	X	X	X	X	X	X
3. <i>Melete</i>		X	X		X	X	
4. <i>Eurema</i>	X	X	X	X	X	X	X
5. <i>Phoebis</i>	X	X	X	X	X	X	X
6. <i>Anteos</i>	X	X	X	X	X	X	X
7. <i>Kricogonia</i>	X	X	X	X	X		X
8. <i>Zerene</i>		X	X	X	X	X	X
9. <i>Nathalis</i>		X	X	X	X	X	X
10. <i>Dismorphia</i>	X	X	X		X	X	X
11. <i>Danaus</i>	X	X	X	X	X	X	X
12. <i>Lycorea</i>	X	X	X		X	X	X
13. <i>Anelha</i>		X	X	X	X		
14. <i>Hymenitis</i>		X	X	X	X	X	
15. <i>Calisto</i>	X	X	X	X			
16. <i>Heliconius</i>	X	X	X	X	X	X	X
17. <i>Eudeides</i>	X	X	X		X	X	
18. <i>Metamandana</i>			X		X	X	
19. <i>Colaenis</i>	X	X	X	X	X	X	
20. <i>Dione</i>	X	X	X	X	X	X	X
21. <i>Euploeta</i>	X	X	X	X	X	X	X
22. <i>Physiodes</i>	X	X	X	X	X	X	X
23. <i>Chlosyne (Synchloe)</i>	X	X	?	X	X	X	
24. <i>Vanessa</i>	X	X	X	X	X	X	X
25. <i>Hypanartia</i>	X	X	X	X	X	X	
26. <i>Precis (Junonia)</i>	X	X	X	X	X	X	X
27. <i>Anartia</i>	X	X	X	X	X	X	X
28. <i>Metamorphia (Victorina)</i>	X	X	X	X	X	X	X
29. <i>Athena (Timetes)</i>	X	X	X	X	X	X	X
30. <i>Hypolimnas</i>	X	X	?	X		X	X
31. <i>Historis</i>	X	X	X	X	X	X	X
32. <i>Coea (Historis)</i>	X	X	X	X	X	X	X
33. <i>Colobura (Gynaecia)</i>	X	X	X	X	X	X	
34. <i>Lucinia</i>		X	X	X			
35. <i>Eunica</i>	X	X	X	X	X	X	X
36. <i>Dynamine</i>		X	X	X	X	X	X
37. <i>Cystineura</i>			X	X	X	X	
38. <i>Didonis</i>	X		X		X	X	
39. <i>Ageronia</i>	X		X	X	X	X	X
40. <i>Myscelia</i>			X		X	X	X
41. <i>Adelpha (Heterochroa)</i>	X	X	X	X	X	X	X
42. <i>Doxocopa</i>		X	X	X	X	X	
43. <i>Asterocampa (Apatura)</i>	X	X			X		X
44. <i>Prepona</i>	X	X	X		X	X	
45. <i>Siderone</i>	X	X	X		X	X	
46. <i>Anaea</i>	X	X	X	X	X	X	X

Distribution of Antillean Genera of Pieridae, Danaidae and Nymphalidae.

(4) By wind drift or air currents. I consider this the least important, taking in consideration the geographical position of the Island.

LAND MIGRATION

I believe, as do many other investigators, that the greatest percentage of our insect fauna came to us by land migration little by little from west to east. Since the beginning of the Paleocene, or perhaps a little earlier, somewhere at the end of the Cretaceous, our Island was supposed to be covered with vegetation, altho there is no evidence from Cretaceous formations concerning the nature of this early flora. However, several deposits of our fossil flora were discovered during the years 1915 to 1926, all of them being identified by Mr. Arthur Hollick (1928). This early flora has been said to have been in existence sometime during the lower Miocene to the upper Eocene. If this is true, undoubtedly by that time the Island was entirely covered by large forests in their primaeval stages. Of course, there is no reason to doubt that forests existed in the Island long before the lower Eocene; perhaps they started just at the end of the Cretaceous. It is also to be taken into consideration that the Island has been emergent since its first uplift during the late Cretaceous. It had only slight submergences afterwards but its main range of mountains continued to the present to stay above the surface of the seas. Taking in consideration that the known geologic history of Puerto Rico really started sometime during the middle of the Cretaceous, this will serve as a starting point to trace the migrations of fauna from Central America to Antillea. During the largest part of the Mesozoic era, Honduras and Nicaragua were probably connected with the Greater Antilles (including Puerto Rico). Of course, the effect of the faunal migrations during those ages should not be taken into consideration, because most of it disappeared during the great inundations of the Antillean Revolution, which ended the Mesozoic. Right at the end of the Mesozoic, Antillea was a huge land mass again connected to Central America by means of the Nicaraguan Banks. This connection lasted all through the early Eocene, early Oligocene and early Pliocene. During all these millions of years fauna and flora were constantly flowing from west to east by way of Jamaica, Hispaniola to Puerto Rico and the Virgin Islands. Puerto Rico kept its connections with Hispaniola continuously from its emergence during the middle Cretaceous up to late Pliocene times, about 4 or 5 millions years ago, roughly speaking. A little after, the connections between Puerto Rico and the Virgin Islands were broken, and it has been so up to the present time. Most biogeographers believe that Hispaniola and Jamaica were the main centers of dispersion of the Antillean fauna and flora.

When we compare the small size of our Island and study its flora and fauna, we must come to the conclusion that we have an extremely large number of species both in insects and plants. Of course, in modern times, it would be rather difficult to judge this statement. How many hundreds of species have disappeared from this Island, due to the environmental changes produced artificially by man? Nobody knows so far and probably nobody ever will know the answer. Long before naturalists began to study the insect fauna in this Island, man was already changing the environmental conditions for insect life by clearing of lands, by the destruction of our forests, particularly those on the hillsides. What became of those insect species which used to dwell in the semi-darkness of a low tropical forest? Were they all extinguished, long before scientists started their collections in Puerto Rico?

Why do we not have in Puerto Rico this species or this group of insects represented in our fauna, if they are so abundant in South America, Central America and other of the West Indian islands?

Dr. Osborn (1932) specifically cites the case of the genus *Tomaspis* of the Cercopidae, where he points to the fact that the number of species in the genus is reduced in number in the Greater Antilles from west to east, until it comes to Puerto Rico where not a single one has been recorded. This question is as difficult to answer and as puzzling as the following. Why is it that *Phyllophaga portoricensis* (Smyth) and *P. vandinei* (Smyth), two of our most common May-beetles, each of which lives in its own section of the island of Puerto Rico, the species *portoricensis* with a limited distribution in the eastern two-thirds of the Island and *vandinei* on the rest of the western part do not intermingle? Yet this is on the same island and more or less under the same ecological conditions. The recent importations of parasites to Puerto Rico, has taught us many strange things about insect behavior.

Why is it that some insect parasites are introduced into Puerto Rico from tropical regions of the World, like Brazil, Trinidad Venezuela, etc., and behave as if they were in their native country? On the other hand, others do not. They might subsist for a few months and then disappear never to be recovered again.

There are yet, many strange things in insect behavior which science has to solve and it is going to be a very hard task. When these questions are answered, then we will be in a position to understand certain puzzling problems of our past insect life.

Gleason & Cook (1927) in their discussion of the origin of our insular flora and its evolution bring out the following points, which can be applied to the origin and evolution of our insect fauna. They say (pages 14-15):

If the various possibilities of migration and evolution are collated, it

will be seen that the species of Porto Rico may be divided into several different categories:

A. Species common to Puerto Rico and other parts of the world.

1. Originating elsewhere by evolution and reaching Puerto Rico by immigration.
2. Originating in Puerto Rico by evolution and reaching other lands by emigration.
3. Originating both in Puerto Rico and in other lands by evolution from a common ancestral stock.

B. Species endemic to Puerto Rico.

4. Originating elsewhere by evolution, reaching Puerto Rico by immigration and becoming extinct in their original habitats.
5. Originating in Puerto Rico and not at present colonized on other lands by emigration.

As stated before, the trend of migration was from west to east, Puerto Rico and the Virgin Islands being the last ones to receive the current of migrations. What were the barriers that stopped in part the greater migration of insects to Puerto Rico and the Virgin Islands? Such factors as migrating against the trade winds, meeting with high mountains on their travel to the east, perhaps differences in rainfall, humidity and temperatures might be considered.

The Antillean trade winds all come from the east or northeast. If this has been the situation since early geologic times when the fauna started to be distributed on the Antilles, undoubtedly it was a handicap to insect flight. It certainly did not help in the distribution of insects in a west to east direction. Of course, a million years ago by the beginning of the Pleistocene, glaciation took place in other parts of the world. What effect this sudden cooling of the earth's surface had in the wind currents of the Antilles is not known, but by that time the form and shape of the land mass formerly known as Antillea was changed and the islands appeared more or less as they are today. Any change which might have taken place in wind drift during the Glacial epochs might only affect the drifting of insects from island to island across the seas.

Supposing that during the beginning of the Pleistocene we had hundreds of more species than the ones we have now in Puerto Rico and supposing our insect fauna was as large as that of Hispaniola or Jamaica, what effect had the sudden changes of temperatures during the glaciation in the insect fauna of the Antilles? Did it extinguish forever more species in Puerto Rico than in Hispaniola, Jamaica or Cuba? Questions like these might give a clue to the inquisitive tendencies of scientists to account for our poverty in insect fauna, not only in Puerto Rico, but in the Antilles in general.

MIGRATORY HABITS

Some species of insects, especially butterflies, show migratory habits. This may account for the homogeneous distribution of some species of butterflies throughout the Antilles. Many species of butterflies as well as moths are very strong fliers. The islands of the Greater Antilles as well as those of the Lesser are fairly close, so most of these strong fliers could possibly pass from island to island by means of their flight, others by their power of flight plus their migratory instincts.

ACTIVITIES OF MAN

Long before the coming of white men to the New World, the Caribs were known to make frequent trips from one island to another in the Caribbean region. In this way they introduced scores of plants and with them undoubtedly many insects. Then came the arrival of the Europeans four centuries ago and the subsequent introduction of plants and trees from the Old World to the Antilles. Moreover, interisland commerce was fostered on a more or less small scale. All these human activities helped in the introduction of new insect pests from one place to another. Even in modern times we have noticed the recent accidental introduction of insect species which were never recorded from Puerto Rico until the last few years, but known to be common in the other islands of the Antilles. This is particularly obvious when we take into consideration the large amount of wood and tree trunks, which have been imported recently from Hispaniola to Puerto Rico. Undoubtedly this has helped to increase our forest insect fauna somewhat.

The activities of man, on the other hand have contributed in a certain way in the destruction of our insect fauna. Many insect species which were very common fifty years ago are so rare now as to be considered nearly extinguished. The complete destruction of our lowland forests as well as the partial deforestation in our mountains has undoubtedly brought a tremendous upset in the ecological conditions for insect life. This is particularly noticeable in those insect species which were the sole inhabitants of our lowland and hillside forests.

Why is it that such species as *Kricogonia castalia* (Fabr.), *Anteos maerula* (Fabr.) and *Acolastus amyntas* (Fabr.) are so rare? There is only one reason to account for their nearly complete extermination in the Island: the destruction of their original host plants or trees. Other specific cases could be cited in almost every group of insects and all tending towards one main clue: the changing of environmental conditions by man since he settled the Island four centuries ago.

How many insect species that possibly inhabited the island of Puerto Rico had already disappeared and never were recorded by early scientists?

We will never be able to tell. The same can not be said about Hispaniola, or Cuba, where there are still thousands of acres of forests more or less in the virgin state, which man has not yet had the chance to destroy or change in any way.

AIR CURRENTS

As Osborn says (1932) the continuous trade winds from east to west and the westward movements of storms through the West Indies can easily be conceived as a powerful agent in preventing the eastward movement of insects and also of carrying such insects as are present on the eastern islands to those of the west.

The air currents have prevented the eastward movement of insects but in part have helped a little to the introduction of perhaps a small percentage of our insect forms which have a South American origin. I believe, as Petrunkevitch says (1928) referring to the spider fauna, that the last traces of the spider fauna of the Lesser Antilles which is purely South American in origin is found admixed in Puerto Rico with the one that came from the west. The same probably is true with some of our insects which supposedly were introduced from the Lesser Antilles by air currents. Of course the greater section of the Lesser Antilles is too far south of Puerto Rico and thus the trade winds coming from those islands never have a chance to touch the Island directly. Only during cyclonic disturbance are the wind currents disturbed in the Caribbean. It is very possible that a cyclonic disturbance starting in these islands could travel hundreds of miles in a northwestern direction or on a nearly northern direction and then change its course towards the west to hit our Island.

We know of a particular instance where a species appeared in Puerto Rico soon after a hurricane: the wasp, *Polistes major* Beauvois. Never recorded from Puerto Rico, but yet present on the islands east of Puerto Rico, it was first noted after the San Felipe hurricane of the 13th. of September 1928. At present this species is almost as common as our native species, *Polistes crinitus* (Felton).

How many insects have been introduced in this way from the islands of the Lesser Antilles is a problem yet to solve.

In closing this discussion the writer presents the following conclusions:

(1) That our insect fauna is purely of Central and South American affinities.

(2) That this fauna came to Puerto Rico by land migrations from Central America to Jamaica, Hispaniola and Puerto Rico.

(3) In a smaller degree by the migratory habits of certain groups of insects; by the activities of man and in a lesser degree by air currents.

(4) The endemic species originated by means of evolution in the Island,

or else originated elsewhere by evolution reaching Puerto Rico by immigration and becoming extinct in their original habitats.

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Acnistus

Acnistus arborescens (L.) Schlecht.

(Solanaceae)

DISTRIBUTION: A shrub or a small tree, growing in woods and thickets, in wet or moist sections in the central districts of Puerto Rico, ascending to higher elevations. Also recorded from St. Thomas, Jamaica, Saba, Guadeloupe, from Trinidad to Montserrat and continental tropical America.

COMMON NAMES: "Gallinero," "Galán arbóreo" and "Palo de gallina."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding on the leaves of a tree (IB:298) Guánica, 1913.

Acrocomia

Acrocomia media Cook

(Arecaceae)

DISTRIBUTION: A palm, growing on plains and hillsides, at lower and middle elevations in moist and dry districts of Puerto Rico, rare or absent in the wet eastern parts of the island. Recorded also from St. Thomas, Jamaica, Hispaniola, St. Kitts, Antigua, Guadeloupe, Dominica, Martinique, Grenada and Trinidad. (In Britton & Wilson, Vol. 5, p. 115 as: *Acrocomia aculeata* (Jacq.) Lodd.)

USES: Its wood is used in the manufacturing of walking sticks.

COMMON NAMES: "Corozo," "Palma de corozo" and "Grugrú."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

(Coccidae)

Ischnaspis longirostris (Signoret)

Attacking leaves of palms, at Río Piedras (IB:143), 1914.

Pinnaspis buxi (Bouché)

Attacking leaves of palms, at Río Piedras (IB:136), 1914.

Agati

Agati grandiflora (L.) Desv.

(Fabaceae)

DISTRIBUTION: A tree, growing along roadsides and in thickets, spontaneous after cultivation in Puerto Rico, Vieques, St. Croix, St. Thomas and St. Jan. Native to tropical Asia.

USES: The white, soft, light and not durable wood is used for poles, posts of native houses and firewood. Parts of the tree are used medicinally and as food.

COMMON NAMES: "Gallito," "Cresta de gallo," "Báculo" and "Sesbán."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

(Cicadellidae)

Agallia albidula Uhler

Causing considerable injury to the foliage (IB:75), 1921.

Cicadella sirena Stål

(IB:79), 1921.

Empoasca fabalis DeLong & Wolcott

All stages abundant, attacking the foliage and causing yellowing and shedding of leaves. (IB:91), 1913.

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding on the foliage (IB:298), 1913.

LEPIDOPTERA

(Phalaenidae)

Anticarsia gemmatilis (Hübner)

Caterpillars feeding on the foliage (IB:437), 1916. (Recorded as *Thermesia gemmatilis* Hüb.)

Alauca flavicapilla (Möschler)

Caterpillar on host tree (IB:437), 1912.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) *costalis* (Holmgren)

(Termitidae) A tree about 25 ft. high, with nest and tunnels on the trunk. Manatí, Aug. 30, 1941. (LFM.)

Agati

COLEOPTERA

Chrysobothris megacephala Castelnau & Gory

(Buprestidae) Larvae obtained from trunk of tree, reared to adults by Mr. E. G. Smyth. (IB :215), Guánica, July 1931.

Albizia

Albizia lebbbeck (L.) Benth.

(Mimosaceae)

DISTRIBUTION: A tree, growing along roadsides, in fields and on hillsides, in Puerto Rico, Culebra, Vieques, St. Croix and St. Thomas. A native of the Old World tropics, widely naturalized in the West Indies.

USES: Locally it is mainly used for shade and ornamental purposes. The dark brown wood is hard, strong and durable. Elsewhere it is used for house and boat construction, furniture, sugar-cane crushers, etc. Its gum, is employed as an adulterant of gum arabic in calico printing.

COMMON NAMES: "Amor platónico," "Acacia amarilla," "Cassia amarilla," Thibet tree, Women's tongue, East Indian walnut and Siris tree.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) *costalis* (Holmgren)

(Termitidae) Nest on tree at Lares (SIB :43), 1940. Also several large trees with nests and tunnels on the trunks, at Santurce, Sept. 14, 1940. (LFM.)

COLEOPTERA

Chalcolepidius silbermanni Chevrolat

(Elateridae) Reared from the trunk of a dead tree, infested with Cerambycid beetles larvae, at Ponce (SIB :88), 1939. (LFM.)

Chlorida festiva (Linnaeus)

(Cerambycidae) Tree completely bored by larvae and adults. One dead adult collected at entrance of bore. Ponce, Aug. 23, 1940. (LFM.)

Albizia

Elaphidion irroratum (Linnaeus)

(Cerambycidae) Reared from the trunk of a dead tree, boring in trunk, at Ponce (SIB:99), 1939. (LFM.)

Elaphidion spinicorne (Drury)

Reared from the trunk of a dead tree, at Ponce, (SIB:99), 1939. (LFM.)

Xyleborus affinis Eichhoff

(Scolytidae) Apparently killing a previously sound and healthy tree. Rio Piedras, Jan. 5, 1945 (F. Seín).

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults defoliating trees at Río Blanco, Naguabo, altitude 250 ft., May 27, 1941. (LFM.)

Albizia procera (Willd.) Benth.

(Mimosaceae)

DISTRIBUTION: This tree is native to southern Asia and has only been recently introduced into Puerto Rico. It is planted along roadsides and in gardens. Also recorded from St. Thomas.

USES: The brown heartwood is used in India for posts, agricultural implements and other types of construction.

COMMON NAMES: "Albizia" and White siris.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trunk of a tree, at Río Piedras, Dec. 1940. (LFM.)

Albizia**HYMENOPTERA****Xylocopa brasilianorum** Linnaeus

(Xylocopidae) One adult collected in bore, in a trunk of a partly dead tree, at Santurce, Feb. 6, 1941. (LFM.)

Alchornea*Alchornea latifolia* Sw.

(Euphorbiaceae)

DISTRIBUTION: A tree, growing in forests and on wooded hills in wet or moist districts of Puerto Rico, ascending at least 700 meters. Also recorded from Tortola, Jamaica, Cuba, Hispaniola, Mexico and Central America.

COMMON NAMES: "Achiotillo," "Palo de cotorra" and "Jobillo."

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Tunnels on trunk of tree, at Luquillo, 1941. (LFM.)

Aleurites*Aleurites moluccana* (L.) Willd.

(Euphorbiaceae)

DISTRIBUTION: A tree, native to the East Indies. Introduced into Puerto Rico and afterwards widely planted on the island. Also recorded from St. Croix and St. Thomas.

Aleurites

USES: The nuts produced by this tree, yield a valuable oil. The tree is planted along roadsides and gardens.

COMMON NAMES: "Nuez," "Nuez de India," Otaheite walnut, Candle-nut, Candleberry tree and Indian walnut.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Aspidiotus cyanophylli Signoret
(Coccidae) Listed (IB:137).

Amomis

Amomis caryophyllata (Jacq.) Krug & Urban

(Myrtaceae)

DISTRIBUTION: A tree, growing on hillsides and in forests, at lower and middle elevations in moist districts of Puerto Rico. Recorded also from Vieques, St. Croix, St. Jan, Tortola, Cuba, Hispaniola, St. Martin to Trinidad and northern South America.

USES: The leaves have the taste and odor of lemon, from which an essential oil or bay oil is obtained by distillation. The dark wood is strong, very hard and durable. It is utilized for rollers, sills, posts and to some extent in carpentry.

COMMON NAMES: "Malagueta," "Ausú," "Guayavita," "Limoncillo," "Pimienta malagueta," Wild cinnamon, Bayberry tree and Bay rum tree.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding on young trees, about a year and a half old, at Río Piedras, altitude 200 ft., June 1, 1941. (LFM.)

Amyris*Amyris elemifera* L.

(Rutaceae)

DISTRIBUTION: A shrub or a tree, growing in thickets and on hillsides at low elevations, most abundant in the dry southern districts of Puerto Rico. Also recorded from Mona, Desecheo, Icacos, Culebra, Vieques, St. Croix, St. Jan, St. Thomas, Anegada, Florida, Cuba, Jamaica, Hispaniola and Central America.

USES: The yellow, hard, strong and durable wood, is used for furniture. People in the country use the wood for making torches, for fishing at nights and also for lighting their huts.

COMMON NAMES: "Tea," "Palo de tea," "Cuabilla" and Torchwood.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA**Artipus monae** Wolcott

(Curculionidae) Observed adults feeding on the tender leaves, Mona Island, April 5, 1944. (GNW.)

Insects Affecting the Twigs

HOMOPTERA**Pseudoparlatoria parlatorioides** (Comstock)

(Coccidae) At Dorado, (SIB:62).

Insects Affecting the Trunk

ISOPTERA**Kalotermes (K.) snyderi** Light

(Kalotermitidae) Trunk of tree infested at Mona Island. (Martorell, 1941, p. 81.)

Anacardium*Anacardium occidentale* L.

(Anacardiaceae)

DISTRIBUTION: A tree, growing on hillsides and plains at lower elevations in moist and dry districts of Puerto Rico. Also recorded from Cule-

Anacardium

bra, Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Jamaica, Cuba, Hispaniola, St. Martin to Trinidad and continental tropical America.

USES: The tree is often planted for its fruits and nuts.

COMMON NAMES: "Pajuil," "Cajuil," "Acajú," "Marañón," Cashew nut or Cashew tree.

INSECT RECORDS

Insects Affecting the Fruits

DIPTERA

Anastrepha mombinpraeoptans Señ

(Tephritidae) Reared from fruits, at Dorado, (SIB:119).

Insects Affecting the Leaves

THYSANOPTERA

Selenothrips rubrocinctus (Giard)

(Thripidae) On cashew (IB:65). Heavy infestation, causing yellowing of leaves, on several trees, at Yabucoa, Feb. 1939. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Large tree killed by attack of termites, on which the nest rested. All the upper branches were covered with tunnels, except where the bark had fallen away, and the only sign of life was watershoots coming up from the base. Vega Baja beach, March 14, 1941. (GNW.)

Andira

Andira jamaicensis (W. Wright) Urban

(Fabaceae)

DISTRIBUTION: A tree, growing in woodlands, on hillsides and river banks, ascending to higher elevations, in Puerto Rico. Also recorded from

Andira

Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Jamaica, Cuba, Hispaniola, from St. Kitts to Trinidad and continental tropical America. (In Britton & Wilson, Vol. 5, p. 409 as: *Andira inermis* H.B.K.)

USES: The wood is used in carpentry and construction, for canes and handles, piles and boats. It is reddish yellow, hard, strong and durable, with a specific gravity of about 0.8.

COMMON NAMES: "Moca," "Moca blanca," Angelin tree, Bastard mahogany, Cabbage tree and Bastard cabbage tree.

INSECT RECORDS**Insects Affecting the Leaves****ORTHOPTERA****Microcentrum triangulatum** Brunner

(Tettigonidae) Nymphs and adults, feeding voraciously on leaves of trees, at Cayey, 1940. (LFM.)

COLEOPTERA**Phyllophaga vandinei** (Smyth)

(Scarabaeidae) Adults defoliating trees, at San Sebastián (SIB:96), 1940 (LFM.) Also (IB:249) 1923.

Exophthalmodes roseipes (Chevrolat)

(Curculionidae) At Algarrobo (IB:293), 1932. Presumably feeding on the foliage. (Listed as *Prepodes roseipes* Chevrolat.)

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) At Ponce, Patillas and Isabela (IB:298), 1931. Heavy defoliation of trees, at Santa Isabel, Oct. 15, 1940; also at Quebradillas, May 22, 1941. (LFM.)

LEPIDOPTERA**Phostria originalis** (Lederer)

(Pyraustidae) Caterpillars on host trees, at Aibonito and Barranquitas, causing heavy defoliation. (SIB:130), 1936. An outbreak of the same insect, at Cayey, on the Cayey-Salinas road, during February and March of 1940, altitude 2500 ft. (LFM.)

Megalopyge krugii (Dewitz)

(Megalopygidae) At Cayey (SIB:138), 1940. Outbreak of caterpillars attacking many trees, causing complete defoliation at Ponce, Sept. 19, 1940. On April 17, 1942 on the Ponce-Sta. Isabel road, near Ponce, about 20 trees in a row, were completely defoliated by tremendous numbers of larvae. (LFM.)

Andira

Insects Affecting the Twigs

HOMOPTERA

Saissetia oleae (Bernard)

(Coccidae) Very heavy infestation on twigs and smaller branches. Terminals dead and scales so thick that the twigs looked brown. Patillas, Aug. 27, 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) *costalis* (Holmgren)

(Termitidae) Tunnels and nests in small and large trees, along roadsides at Ponce, Salinas, Santa Isabel, Guayama, Cayey, Sept. 1940. Large nest on trunk of tree, at El Verde, Río Grande, Aug. 1941. (LFM.)

COLEOPTERA

Synchita granulata Say

(Colydiidae) Few specimens collected under the bark of a living tree, near Ponce, at El Pastillo. What appeared to be the larva of this species, was also present. It seems possible that they prey on the weevil larvae found in the bark of the tree. May, 1940. (Notes by D. DeLeón.)

Platypus rugulosus Chapuis

(Platypodidae) Adults fairly common in early May, boring into broken limbs of trees, at Ponce, May 1940. (D. DeLeón.)

Xyleborus confusus Eichhoff

(Scolytidae) A single adult collected from branch of host tree, at El Pastillo, near Ponce, May, 1940. (D. DeLeón.)

Annona

Annona diversifolia Safford

(Annonaceae)

DISTRIBUTION: Introduced and planted at the Río Piedras Agricultural Experiment Station.

Annona

USES: The tree is planted for its fruit.

COMMON NAMES: "Anona blanca."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Empoasca minuenda Ball

(Cicadellidae) Listed in (IB:91).

Annona glabra L.

(Annonaceae)

DISTRIBUTION: A tree, growing in coastal swamps, along the borders of marshes and on stream banks, at low elevations in Puerto Rico. Also recorded from Vieques, St. Thomas, St. Jan, St. Croix, Virgin Gorda, Tortola, Florida, Cuba, Jamaica, Hispaniola, Panama, South America, west coast of Africa and Galapagos Is.

USES: The brownish wood is soft, weak and not durable. It is very light in weight, with a specific gravity of only 0.5; thus it is mainly used for floats, rafts and stoppers.

COMMON NAMES: "Cayur," "Corazón cimarrón," Cork wood, Alligator apple, Pond apple, Monkey apple, Mangrove annona and Dog apple.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Aspidiotus destructor Signoret

(Coccidae) At Algarrobo (IB:138), 1914. Presumably on the leaves of tree. At Punta Picúa, Mameyes, infesting undersides of leaves, causing yellow mottling. Sept. 27, 1944. (GNW. & LFM.)

LEPIDOPTERA

Gonodonta maria Guenée

(Phalaenidae) The caterpillar feeds on this tree, according to Möschler, 1890, p. 183.

Annona*Annona muricata* L.

(Annonaceae)

DISTRIBUTION: A tree, growing in thickets and on hillsides, in Puerto Rico. Also recorded from Vieques, St. Thomas, St. Croix, St. Jan, Virgin Gorda and Tortola.

USES: The soft, light, brown and not durable wood is of little use except for fuel. The tree is widely cultivated in tropical regions for its fruit, which can be eaten raw when ripe or used to make a cooling drink. An infusion of the leaves is used as a remedy for dysentery.

COMMON NAMES: "Guanábana" and Sour sop.

INSECT RECORDS

Insects Affecting the Fruits

HYMENOPTERA**Bephrata cubensis** Ashmead

(Eurytomidae) Reared from the fruits, the larvae attack the seeds, destroying a large percentage of them. (IB:534), 1925. (LFM.)

Insects Affecting the Leaves

HEMIPTERA**Corythucha gossypii** (Fabricius)

(Tingitidae) At Maricao, Isabela, Aguada, Cabo Rojo and Río Piedras, (IB:162). In altitudes from sea level to more than 2,000 ft. (LFM.)

LEPIDOPTERA**Cocytius antaeus antaeus** (Drury)

(Sphingidae) According to Möschler, p. 111, the caterpillar of this moth, breeds on *Annona muricata* L. (IB:445).

Protambulyx strigilis (Linnaeus)

(Sphingidae) The larvae (? of this species) on tree (IB:447), 1919.

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Asterolecanium pustulans (Cockerell)

Recorded by Mr. A. Busck, on tree, Feb. 21, 1889 at San Juan. (IB:122).

Annona**Pseudococcus nipae** (Maskell)

At Corozal, Ponce, Añasco, Mayagüez and Maricao (IB:126). Heavy infestation on leaves, twigs and sometimes on fruits, at Yabucoa and Santurce, June 1941. (LFM.)

Saissetia hemisphaerica (Targioni)

At Maricao (IB:131-2).

Saissetia oleae (Bernard)

At Maricao (IB:133). Trees heavily infested at Santurce and Yabucoa, June 1941. (LFM.)

Pinnaspis minor (Maskell)

At Ponce (IB:137). Listed as *Hemichionaspis minor* Maskell.

Selenaspidus articulatus (Morgan)

At Río Piedras (IB:138). Listed as *Pseudaonidia articulatus* Morgan

Chrysomphalus aonidum (Linnaeus)

Listed in (IB:139).

Aonidiella aurantii (Maskell)

Collected by Mr. A. Busck at Ponce and San Juan on Feb. and January 1899 (IB:138).

Chrysomphalus personatus (Comstock)

Collected by Mr. A. Busck, at San Juan, Feb. 5, 1899 (IB:140).

Annona reticulata L.

(Annonaceae)

DISTRIBUTION: A small tree, growing along roadsides, in woods, pastures and on hillsides, in Puerto Rico. Recorded also from St. Thomas, St. Croix, St. Jan, Cuba, Jamaica and Hispaniola.

USES: The tree is widely cultivated for its fruit in tropical regions. The brownish wood is light and weak; the bark contains a strong fiber.

COMMON NAMES: "Corazón," Custard apple and Bullock's heart.

Annona

INSECT RECORDS

Insects Affecting the Fruits

DIPTERA

Anastrepha unipuncta Seín

(Tephritidae) Reared from the fruit (IB:378).

HYMENOPTERA

Bephrata cubensis Ashmead

(Eurytomidae) Reared from fruits, the larvae attacking the seeds, at Villalba (IB:534).

HOMOPTERA

Pseudococcus nipae (Maskell)

(Coccidae) Heavy infestation, nearly covering the whole fruit, at Cayey and Guayama; also at San Sebastián. Not so abundant at higher elevations. Feb. 1941. (LFM.)

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Asterolecanium pustulans (Cockerell)

Listed in (IB:122).

Pseudococcus nipae (Maskell)

Listed in (IB:126), 1914.

Ceroplastes floridensis Comstock

Listed in (IB:129). Collected by Mr. A. Busck, in 1889.

Saissetia hemisphaerica (Targioni)

At Mayaguez (IB:132). Few scales observed on twigs of tree at Lares, Dec. 11, 1941. (LFM.)

Pinnaspis minor (Maskell)

Listed as *Hemichionaspis minor* Maskell, in (IB:137), 1915.

Selenaspidus articulatus (Morgan)

Listed as *Pseudaonidia articulatus* Morgan, in (IB:139).

Ardisia*Ardisia obovata* Desv.

(Myrsinaceae)

DISTRIBUTION: A shrub, growing in woodlands, forests, thickets and on river banks, at lower and middle elevations, in Puerto Rico. Also recorded from Vieques, St. Jan, St. Thomas, St. Croix, Tortola, Virgin Gorda, Bahamas, from Saba to St. Lucia. (In Britton & Wilson, Vol. 6, p. 57 as: *Icecorea guadalupensis* (Duch.) Britton.)

USES: Its wood is light reddish brown, hard and heavy. It has been used for furniture.

COMMON NAME: "Mameyuelo."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA**Saissetia hemisphaerica** (Targioni)

(Coccidae) Infesting branches and leaves, at Guajataca Gorge, near Quebradillas, Nov. 24, 1940. (LFM.)

Areca*Areca catechu* L.

(Arecaceae)

DISTRIBUTION: A palm, introduced and planted in Puerto Rico and St. Thomas. Native of Asia.

USES: Locally of no use. In its native country the nuts or seeds are used for medicinal purposes, tooth paste and powder and as a vermifuge for dogs.

COMMON NAMES: "Nuez de areca," "Palma de indio." Betel nut, Betel palm and Areca nut.

INSECT RECORDS

Insects Affecting the Leaves

Areca

LEPIDOPTERA

Atrytone vitellius (Fabricius)

(Hesperiidae) Male and female reared from larvae feeding on leaves of palm (SIB:124, 1938). Listed as *Choranthus hübnéri* Plotz, in synonymy.

COLEOPTERA

Hypolampsis inornata Jacoby

(Chrysomelidae) at Adjuntas, (IB:275). Perhaps feeding on the foliage.

Artocarpus

Artocarpus communis Forst.

. (Moraceae)

DISTRIBUTION: A tree, growing in valleys and on hillsides, spontaneous after cultivation in Puerto Rico, St. Thomas, St. Jan and St. Croix. Native to the southern islands of the Pacific Ocean.

USES: Widely cultivated for its fruit and seeds in all tropical regions; some races seedless. The strong yellowish wood, with a specific gravity of about 0.49, is used for furniture and in construction.

COMMON NAMES: "Pan," "Palo de pan," "Mapén," "Pana forastera," "Panapén," "Pana de pepita" and Breadfruit.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Coccus mangiferae (Green)

(Coccidae) Listed in (IB:131).

Corythucha gossypii (Fabricius)

(Tingitidae) Listed in (IB:162), 1933.

Insects Affecting the Trunk

Artocarpus**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) A very large tree with tunnels around the trunk and branches, at Aguadilla, Oct. 4, 1940. Also at Guajataca, at low altitude and at Aguas Buenas, at 1,000 ft. high, May and August 1941. (LFM.)

COLEOPTERA**Pycnarthrum** sp.

(Scolytidae) Probably an undescribed species, identified by Dr. Blackman. Tremendous infestation, on the trunk of a very recently cut tree, at Guajataca Gorge, near Quebradillas. Beetles boring and breeding in the bark. Altitude 20 ft., Nov. 17, 1940. (LFM.)

Avicennia

Avicennia nitida Jacq.

(Verbenaceae)

DISTRIBUTION: A tree, growing in lagoons and costal swamps, in Puerto Rico. Recorded also from Vieques, Culebras, St. Croix, St. Thomas, St. Jan, Tortola, from Florida to Texas, Bermuda, Cuba, Jamaica, Hispaniola, continental tropical America and the Old World tropics.

USES: The dark brown wood is very hard and durable. It is locally used for foundations, under pinning for houses, fence posts, drains, fuel and charcoal.

COMMON NAMES: "Chifle de vaca," "Mangle bobo," "Mangle blanco," Black mangrove, Olive mangrove and Salt pond.

INSECT RECORDS**Insects Affecting the Trunk****ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nests and tunnels common on the trunk of trees, at Camp Piñones, Boca de Cangrejos, Sept. 15, 1940. Tunnels observed on the trunk of trees, at El Pastillo, near Juana Díaz, June 1941. (LFM.)

Bambos*Bambos vulgaris* Schrad.

(Poaceae)

DISTRIBUTION: A tree-like woody grass, growing in moist grounds and along water courses, at lower elevations, in Puerto Rico, St. Croix and St. Thomas. Widely naturalized in the West Indies and in continental tropical America, from the Old World tropics.

USES: Employed as windbreaks in citrus plantations, although not highly recommended for this use; fence posts; when dry, the wood is polished and varnished and is used in the construction of fancy or artistic articles, such as frames, pin holders, boats and other ornamental pieces.

COMMON NAMES: "Bambú," "Bambúa" and Bamboo.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Asterolecanium bambusae (Boisduval)

At Bayamón and Utuado, collected by Mr. A. Busck, Feb. 1899. At Villalba, listed (SIB:57), 1940. Also at Trujillo Alto, Cidra, Manatí, Maricao and Mayaguez, listed (IB:122). The scale insect very abundant on leaves and twigs and in culms of host plant, at El Yunque Mts., 1,800 ft. altitude, 1940 and also at the mountains north of Villalba, 1,400 ft. in altitude, 1941 (LFM.)

Asterolecanium longum (Green)

On leaves, listed (IB:122), 1914.

Asterolecanium miliaris miliaris (Boisduval)

On three species of bamboo, especially on *Bambos vulgaris* Schrad., at Mayaguez, listed (SIB:57).

Asterolecanium pustulans (Cockerell)

On culms and larger branches of bamboo, listed (SIB:57). (Bartlett.)

Antonina bambusae (Maskell)

At Mayaguez, listed (SIB:58).

HEMIPTERA**Leptodictya bambusae** Drake

(Tingitidae) From bamboo leaves at Mayaguez, collected by Mr. Van Zwualuwenburg, July 11, 1914. This species is also found in Haiti.

Bambos

COLEOPTERA

Scymnillodes cyanescens violaceus Sicard

(Coccinellidae) Feeding on scale insects, *Asterolecanium pustulans* (Cockerell), at Vega Alta, (IB:230), 1917. Also recorded by Bartlett, (SIB:92).

Egius platycephalus Mulsant

(Coccinellidae) Introduced from Cuba, predaceous on bamboo scales, listed (SIB:93).

Chilocorus cacti (Linnaeus)

(Coccinellidae) Introduced from Texas and Cuba, reared on papaya scales in Puerto Rico, released on scale-infested bamboo (SIB:93). Observed feeding on bamboo scales at Mayaguez, Arecibo and Maricao, May 1942. In the last locality mentioned, at more than 2,000 ft. altitude. (LFM.)

LEPIDOPTERA

Panoquina nero (Fabricius)

(Hesperiidae) Larvae feeding on bamboo leaves, listed (IB:411). (*Prenes nero* Fabricius.)

Perichares coridon (Fabricius)

(Hesperiidae) Larvae feeding on leaves, at Mayaguez, listed (SIB:125). (as *Perichares corydon* Fabricius)

Epitomiptera orneodalis (Guenée)

(Phalaenidae) Caterpillar feeding on leaves, at Mayaguez, listed (SIB:128).

Insects Affecting the Roots

THYSANURA

Lepisma sp.

(Lepismidae) Producing pits in the roots of trees, listed (IB:20).

Nicoletia sp.

(Lepismidae) Causing larger pits in the roots of bamboo (SIB:20).

Insects Affecting the Trunk or Culms

COLEOPTERA

Dinoderus minutus (Fabricius)

(Bostrychidae) In dry bamboo (IB:242), 1911. *Peregrinator bianulipes*, as a predator of this insect in Puerto Rico, (SIB:94). (Plank.)

Lyctus caribeanus Lesne

(Lyctidae) In stored bamboo, at Mayaguez (SIB:95).

Barringtonia*Barringtonia speciosa* Forst.

(Lecythidaceae)

DISTRIBUTION: A tree, native to the East Indies, introduced and planted at the Río Piedras and Mayagüez Agricultural Experiment Stations. Also on Mona Is.

USES: The tree is chiefly planted as an ornamental.

INSECT RECORDS

Insects Affecting the Leaves

THYSANOPTERA***Heliothrips haemorrhoidalis*** Bouché

(Thripidae) Listed (IB:65). Feeding on the leaves.

HOMOPTERA

(Coccidae)

Pseudococcus adonidum (Linnaeus)

Listed in (IB:123), 1935; *Averrhoa carambola* Linn. as host tree. (a misidentification, it should be *B. speciosa* Forst.) Few specimens on the undersides of leaves, on large tree at Río Piedras, Oct. 31, 1941. (LFM.)

Pseudococcus nipae (Maskell)

Listed in (IB:127), 1935; *Averrhoa carambola* Linn. as host tree. (a misidentification, it should be *B. speciosa* Forst.) Very heavy infestation on the undersides of the leaves, of large tree, at Río Piedras, Oct. 7, 1940. (LFM.)

Saissetia nigra (Nietner)

On the undersides of leaves, of large tree, at Río Piedras; infestation slight. Oct. 31, 1941. (LFM.)

Aspidiotus cyanophylli Signoret

Listed (IB:137).

Aspidiotus destructor Signoret

Listed in (IB:138), 1935; *Averrhoa carambola* Linn. as host tree. (a misidentification, it should be *B. speciosa* Forst.) Very heavy infestation on the undersides of leaves, of a large tree, at Río Piedras, causing yellowing and shedding of the leaves on the lower branches. Oct. 7, 1940. Also on trees at Mona Island (SIB:61), 1939. (LFM.)

Barringtonia**COLEOPTERA****Chilocorus cacti** (Linnaeus)

(Coccinellidae) Adults and larvae abundant; feeding on scale insects attacking the leaves of a large tree, at Río Piedras, Oct. 28, 1941. (LFM.) Feeding on scale insects *Aspidiotus destructor* Signoret on *Barringtonia* tree at Mona Island, April 5, 1944 (GNW & LFM.)

Bixa*Bixa orellana* L.

(Bixaceae)

DISTRIBUTION: A shrub or a small tree, growing in woods, and on hill-sides, at lower elevations, in Puerto Rico, often spontaneous after planting. Recorded also from Vieques, St. Thomas, St. Croix, Jamaica, Cuba, Hispaniola, from Saba to Trinidad, Margarita and continental tropical America. Neutralized in tropical regions of the Old World.

USES: The wood is little used. A coloring matter extracted from the arillus of the seed is widely used locally for coloring rice, soup, etc., and as the "anatto" of commerce it is extensively used for coloring cheese, chocolates, butter and varnishes.

COMMON NAMES: "Achiote," "Achote," Bixa, Biji, Arnatta and Anatto.

INSECT RECORDS**Insects Affecting the Fruits or Pods****HEMIPTERA****Leptoglossus zonatus** (Dallas)

(Coreidae) Attacking pods, at Adjuntas (IB:170), 1925.

Insects Affecting the Twigs**HOMOPTERA**

(Coccidae)

Inglisia vitrae Cockerell

Listed (IB:130), 1914.

Bixa

Coccus acuminatus (Signoret)

At Salinas (SIB:59).

Howardia biclavis (Comstock)

Collected by Mr. A. Busck, at San Sebastián and Añasco, January, 1899. Later recorded at Bayamón (IB:135) 1912, and recently in (SIB:60).

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Four adults, apparently starting a colony in rotten twigs of tree, at Lares (IB:49) 1921. Tunnels on trunk of trees, at Santurce and Yabucoa, 1940. (LFM.)

COLEOPTERA

Apate monachus Fabricius

(Bostrychidae) An outbreak at Lares, and among other trees, this species was also attacked. Beetles boring in the trunk. (IB:244.)

Derancistrus thomae (Linnaeus)

(Cerambycidae) Larvae in rotten twig of tree, at Lares, June 14, 1921. (IB:259.)

Insects Resting on the Tree

THYSANOPTERA

Selenothrips rubrocinctus (Giard)

(Thripidae) Listed (IB:65). Presumably attacking the foliage.

HEMIPTERA

Leptoglossus stigma (Herbst)

(Coreidae) At Arecibo (IB:170), listed. Possibly doing some damage.

Buchenavia

Buchenavia capitata (Vahl) Eichl.

(Terminaliaceae)

DISTRIBUTION: A large tree, growing in woodlands and forests, in wet or moist districts, mostly at middle and higher elevations, in Puerto Rico.

Buchenavia

Also recorded from Jamaica, Cuba, Hispaniola, from Montserrat to St. Vincent and continental tropical America.

USES: The wood is satiny, hard, strong and heavy, valued for furniture and in general construction.

COMMON NAMES: "Granadillo" and Yellow sanders (Br. W. I.)

INSECT RECORDS**Insects Affecting the Trunk****ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nest on tree, at Las Marias (SIB:43), 1939. Also several trees, with tunnels on trunk, at the Luquillo Mts., altitude 2,000 ft., 1941. (LFM.)

Bucida*Bucida buceras* L.

(Terminaliaceae)

DISTRIBUTION: A tree, growing on plains, hillsides and river banks; also in woods near the coast, at lower elevations, in Puerto Rico. Also recorded from Mona, Vieques, St. Thomas, St. Croix, St. Jan, Florida, Cuba, Hispaniola, Jamaica and Panama.

USES: The light brown or nearly white wood is used for shelves in houses, for mallets, wooden cogs and shingles. It was formerly used for knees in boat building. It is durable, hard, heavy, strong and tough, with a specific gravity of 1.04. A resin exudes from cuts in the trunk; the astringent bark has been used in tanning.

COMMON NAMES: "Ucar," "Ucar blanco," "Bucayo," Wild olive wood of Jamaica and "Bois grisgris" (Haiti).

INSECT RECORDS**Insects Affecting the Leaves****COLEOPTERA****Phyllophaga guanicana** (Smyth)

(Scarabaeidae) Feeding on the leaves of trees, at Guánica, (IB:251), 1917. (E. G. Smyth.)

Bucida

Insects Affecting the Twigs

HYMENOPTERA

Myrmelachista ramulorum Wheeler

(Formicidae) In hollow twigs of host tree, listed (IB:554).

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels and nests abundant on trees at Guajataca Gorge, Ponce, Salinas, Coamo, Guayama and Guánica, 1940. (LFM.)

Nasutitermes (Tenuirostritermes) wolcottii Snyder

(Termitidae) On dead wood of tree, at Boquerón (IB:48), 1923.

COLEOPTERA

Petalium puertoricensis Fisher

(Anobiidae) Reared from log of host tree, at Guánica, April, 1940. (D. DeLeón) (LFM.)

Trichodesma sp.

(Anobiidae) Adults reared between April 22 and May 9, 1940, from logs at Guánica. (D. DeLeón) (LFM.)

Chrysobothris tranquebarica (Gmelin)

(Buprestidae) On dead tree, at Guayanilla (SIB:89) 1937. Boring in the trunk. (LFM.)

Apate monachus Fabricius

(Bostrychidae) Female beetles boring into trunk of trees, at Guayanilla, (SIB:94), 1937. (LFM.)

Cylindera flava (Fabricius)

(Cerambycidae) All stages infesting logs, at Guayanilla, (SIB:99), 1937. (LFM.)

Neoclytus araneiformis (Olivier)

(Cerambycidae) All stages in logs, at Guayanilla (SIB:99), 1937. (LFM.)

HYMENOPTERA

Callihormius sp.

(Braconidae) Two males and ten females were reared between April 23 and May 9, from a dead tree, which probably was this species. The

Bucida

anobiid, *Petalium puertoricensis* Fisher was reared from the same log, and is probably the host of this parasitic wasp. (D. DeLeón.) Guánica, 1940. (LFM.)

Insects Resting on the Tree

COLEOPTERA

(Chrysomelidae)

Metachroma antennalis Weise

Listed (IB:270), at Ponce. Possibly feeding on the leaves.

Metachroma wolcottii Bryant

At Juana Díaz, listed (IB:270). Possibly feeding on the foliage.

Bursera*Bursera simarouba* (L.) Sarg.

(Burseraceae)

DISTRIBUTION: A tree, growing in woodlands, on hillsides and along creeks, at lower and middle elevations, most abundant in the dry districts of Puerto Rico. Recorded also from Mona, Desecheo, Icacos, Culebra, Vieques, St. Jan, St. Croix, St. Thomas, Tortola, Florida, Cuba, Jamaica, Hispaniola, Mexico and continental tropical America. (In Britton & Wilson, Vol. 5, p. 461 as: *Elaphrium simarouba* (L.) Rose.)

USES: Often planted as a roadside tree, for shade. The wood is light brown, often with bark discolorations, fine grained, very soft, spongy, light, weak and not durable. The tree is much used in domestic medicine, the gum and sometimes the leaves being the parts employed. Diaphoretic, purgative, diuretic and expectorant properties are attributed to it; so it is employed for dysentery, dropsy, venereal diseases, yellow fever and other affections.

COMMON NAMES: "Almácigo," "Gumbolimbo," West Indian birch, Turpentine tree and Gum tree.

Bursera

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Ceroplastes ceriferus (Anderson)

(Coccidae) At Guánica, listed (IB:129), 1911.

Aleurothrix floccosus (Maskell)

(Aleyrodidae) Infesting trees, and kept under control by means of the parasitic wasp, *Eretmocerus portoricensis* Dozier, (IB:146).

HYMENOPTERA

Eretmocerus portoricensis Dozier

(Aphelinidae) Reared from *Aleurothrix floccosus* (Anderson), infesting tree, at Bayamón, (IB:528).

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels and nests on many trees at the Guánica Insular Forest, Oct. 25, 1940. Trees infested at Guayama, Caycy, Yabucoa, Ponce, Salinas, Mayagüez, June-Aug. 1940. (LFM.) at Vega Baja, (SIB:43).

Kaloterms (K.) snyderi Light

(Kalotermitidae) Listed, from Mona Island (Martorell, Jan. 1941, p. 81.)

COLEOPTERA

Chalcolepidius silbermanni Chevrolat

(Elatridae) Reared from "almacigo" logs infested by the long-horned beetle *Lagochirus araneiformis* (Linn.), collected at Camuy and Quebradillas. The larvae are predators on the larvae of long-horned beetles. (GNW. & LFM.)

Lyctus caribeanus Lesne

(Lyctidae) Collected under the bark of logs, at Guayama, April 1940. (De León & LFM.)

Lyctus curtulus Casey

Collected under the bark of logs, at Guayama, April 1940. (De León & LFM.)

Bursera**Lagochirus araneiformis** (Linnaeus)

(Cerambycidae) Larvae and adults infesting trees at Quebradillas, Camuy, Guajataca and Salinas. The pest is controlled in part by the predaceous insect, *Chalcolepidius silbermanni* (Chevrolat). (GNW. & LFM.)

Cossonus caniculatus (Fabricius)

(Curculionidae) Under bark and chips of wood of trees, recently cut, at Salinas (SIB:105), 1936. (GNW.)

Cossonus impressus Boheman

Many beetles boring in the bark of logs, in trees which were killed by the attacks of cerambycid beetles, August 4, 1941. (det: Buchanan, as "near *impressus* Boheman") (LFM.)

Xyleborus fuscatus Eichhoff

(Scolytidae) Boring into logs of trees, collected at Guayama, near Central Guamaní, May 1940. (DeLeón & LFM.)

Xyleborus grenadensis Hopkins

Boring into logs, adults collected at Guayama, near Central Guamaní, May 1940. (DeLeón & LFM.)

HYMENOPTERA**Zethus rufinodus** (Latreille)

(Eumenidae) Nesting in rotten fence posts, at Laguna Tortuguero, Vega Baja, in (SIB:156), 1940. This insect attacks the rotten wood, but sometimes, it also attacks posts which are sprouting and ready to start out as a new tree. Manatí, Jan. 28, 1941. (GNW.)

Byrsonima

Byrsonima spicata (Cav.) Rich.

(Malpighiaceae)

DISTRIBUTION: A tree, growing in woods and forests, at lower and middle elevations in wet or moist districts of Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Tortola, Cuba, Hispaniola and continental

Byrsonima

tropical America. (In Britton & Wilson, Vol. 5, p. 447 as: *Byrsonima spicata* (Cav.) DC.).

USES: Its wood is reddish brown, hard, strong and heavy, valued for furniture and for construction. The astringent bark is sometimes used in tanning.

COMMON NAMES: "Maricao" and "Doncella."

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA**

Icerya montserratensis Riley & Howard
(Coccidae) Listed (JB:119).

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)
(Curculionidae) Adults feeding on the foliage, of trees, at Km. 11.5 of the Cayey-Salinas road, altitude 1,900 ft., Oct. 19, 1940. (LFM.)

LEPIDOPTERA

Megalopyge krugii (Dewitz)
(Megalopygidae) Considerable damage caused by the larvae, feeding on the foliage of trees, at Aguas Buenas, altitude 800 ft., (Río Piedras-Aguas Buenas Rd.) Dec. 15, 1940. (LFM.)

Monoleuca albicollis Forbes
(Limacodidae) Cocoons very abundant on leaves of host trees, from which many moths were reared. Collected at Doña Juana Camp, on the mountains north of Villalba, altitude 1,900 ft., Oct. 19, 1940. (DeLeón & Martorell.) At same locality, on April 30, 1940. Cocoon also abundant at Cayey-Salinas road, altitude 2,000 ft., 1941 (LFM.) The caterpillar of this moth, presumably breeds on this tree.

Insects Affecting the Trunk**COLEOPTERA**

Hypothenemus eruditus Westwood
(Scolytidae) A single adult collected from a small dead tree, identified as *B. spicata* (Cav.) Rich., at Doña Juana Camp, altitude 1,900 ft., April 1940. (DeLeón.) (LFM.)

Calophyllum*Calophyllum calaba* Jacq.

(Clusiaceae)

DISTRIBUTION: A tree, growing in woodlands, forests and on river banks at lower and middle elevations, mostly in wet or moist districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, Cuba, Jamaica, Hispaniola and Bermuda. (In Britton & Wilson, Vol. 5, p. 584 as: *Calophyllum antillanum* Britton.)

USES: Commonly planted for shade and ornament. The hard, nearly white, durable wood, with a specific gravity of about 0.7, is valued for construction and for posts. Elsewhere it has a variety of uses, such as construction work, ship building, heavy machine work, furniture, felloes of wheels and shingles. The seeds yield an oil, which is used in lamps.

COMMON NAMES: "María," "Palo de María," "Galba," "Calaba," "Santa María," and "Aceite de María."

INSECT RECORDS**Insects Affecting the Leaves and Twigs****HOMOPTERA****Toxoptera aurantii** (Fonscolombe)

(Aphididae) Listed (IB:117).

(Coccidae)

Icerya montserratensis Riley & Howard

At Punta de Cangrejos, Santurce, listed (IB:120), 1916.

Pseudococcus adonidum (Linnaeus)

Listed (IB:123).

Pseudococcus nipae (Maskell)

At Guajataca (SIB:58), 1940. (LFM.)

Eucalymnatus tessellatus (Signoret)Infesting tree, the coccid parasitized by *Ancristus ceroplastae* Howard. (IB:130). Also at Lares, (SIB:59), 1940.**Aonidiella orientalis** (Newstead)Listed as *Aspidiotus cocotiphagus* Marlatt in (IB:137), 1933.**Selenaspidus articulatus** (Morgan)

At Lares (SIB:61), 1940.

Chrysomphalus personatus (Comstock)

Listed (IB:140), 1915.

Calophyllum

(Aleyrodidae)

Aleurodicus antillensis Dozier

Pupal cases on tree, at Santurce, Dec. 21, 1924 (IB:144). (Dozier.)

LEPIDOPTERA

Episimus sp.

(Tortricidae) Caterpillar a leaf-folder on trees, attacking the young leaves, at Vega Baja (SIB:134), 1940. (det: W. M. T. Forbes as: "sp. nov.") (LFM. & GNW.)

HYMENOPTERA

Euderomphale vittata Dozier

(Entedontidae) Reared from large white fly, *Aleurodicus antillensis* Dozier, on host tree, at Santurce, (IB:524), 1924.

Aneristus ceroplastae Howard

(Aphelinidae) Reared from scale insect, *Eucalymnatus tessellatus* (Signoret), on tree, (IB:529).

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Large tree infested at Guajataca, near Camp Guajataca and also at Guajataca Gorge, near Quebradillas, Oct. 24, 1940 and August 5, 1941, respectively. Low altitudes. (LFM.)

Calotropis

Calotropis procera (Ait.) R. Br.

(Asclepiadaceae)

DISTRIBUTION: A tree-like plant, growing in fields, on hillsides and waste grounds in Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Cuba, Jamaica, Hispaniola and continental tropical America. A native of the Old World tropics.

Calotropis

USES: Locally used for ornamental purposes. The fibers of the seeds are twisted into thread by some of the African tribes; the bark is used as a medicine, and from the milk, an inferior rubber or rubber substitute has been obtained.

COMMON NAMES: "Algodón de seda," "Mata de seda," "Bomba," "Mudar" and Giant milkweed.

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA****Aphis nerii** Fonscolombe

(Aphiidae) On trees, on the dry sections of the island; at Yauco, (IB:116), 1914.

LEPIDOPTERA**Danaus plexippus** (Linnaeus)

(Nymphalidae) The caterpillars feeding on the foliage of trees at Yauco and Ponce, (IB:397). (GNW.)

Insects Affecting the Twigs**HOMOPTERA****Pseudaulacaspis pentagona** (Targioni)

(Coccidae) Listed (SIB:60). *As Aulacaspis pentagona*.

Capparis*Capparis baducca* L.

(Capparidaceae)

DISTRIBUTION: A shrub or a small tree, growing in woods and thickets in moist districts of Puerto Rico. Also recorded from Vieques, Culebra, St. Croix, St. Thomas, St. Jan, Tortola, Cuba, Hispaniola, Jamaica, Trinidad, Central and South America.

COMMON NAMES: "Palo de burro," "Sapo" and Rat-bean.

Capparis

INSECT RECORDS

Insects Affecting the Leaves

HEMIPTERA

Corythucha gossypii (Fabricius)

(Tingitidae) On the foliage of tree, at Guánica Insular Forest, (SIB:71), 1940. (LFM.)

Capparis coccolobifolia Mart.

(Capparidaceae)

DISTRIBUTION: A shrub or a small tree, growing in woods, thickets and along creeks, in the eastern and southern districts of Puerto Rico, at lower elevations. Also recorded from Vieques, Culebra, St. Croix, St. Thomas, St. Jan, from Anegada to Trinidad, Curacao and northern South America.

COMMON NAMES: "Burro" and Broad-leaved caper tree.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Ascia monuste (Linnaeus)

(Pieridae) Adults reared from eggs laid on the foliage of trees. Larvae or caterpillars voracious feeders. Collected at Salinas and Cayey, at altitudes ranging from 1,500 to 2,000 ft., Dec. 24, 1940. (LFM.)

Capparis cynophallophora L.

(Capparidaceae)

DISTRIBUTION: A shrub or a small tree, growing on coastal hills and in thickets, in Puerto Rico. Also at Mona, Desecheo, Icacos, Culebra, St. Croix, St. Thomas, St. Jan, Tortola, Florida, West Indies, Mexico, Central and northern South America.

Capparis

USES: The hard, heavy wood is of a fine texture, yellow in color with a faint tinge of red. It is used locally as a fuel, or for making charcoal.

COMMON NAMES: "Burro," "Sapo," "Bejuco inglés," "Burro prieto," Black willow and Black wattle.

INSECT RECORDS**Insects Affecting the Leaves and Pods****LEPIDOPTERA****Dichogamma gudmanni** von Hedemann

(Pyraustidae) The caterpillar is a pod borer and a leaf-webber, causing considerable damage to trees, on the Salinas-Santa Isabel area, at low altitudes, Aug. 20, 1940. (LFM.)

Capparis flexuosa L.

(Capparidaceae)

DISTRIBUTION: A shrub or tree growing in woods, thickets and on hill-sides near the coasts, mostly in dry districts of Puerto Rico. Also in Mona, Desecheo, Icacos, Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Florida, West Indies and continental tropical America.

COMMON NAMES: "Palo de burro," "Palinguán" and Caper tree.

INSECT RECORDS**Insects Affecting the Leaves and Pods****LEPIDOPTERA****Dichogamma fernaldi** Möschler

(Pyraustidae) Caterpillars feeding on the leaves and also boring in pods of trees, at Salinas and Sta. Isabel, altitude 100 ft., Aug. 20, 1940. (LFM.)

Dichogamma redtenbackeri Lederer

Caterpillars feeding on the foliage and webbing leaves. Moths reared from material collected at the following localities: Salinas, Santa Isabel, Yauco, Guánica and Arecibo. Infestations more serious during the months of June-September, at Santa Isabel. Altitudes 100 to 400 ft., 1940. (LFM.)

Capparis

HEMIPTERA

Corythucha gossypii (Fabricius)

(Tingitidae) Nymphs and adults abundant on the undersides of leaves
Mona Island, April 5, 1944. (LFM.)

Insects Affecting the Branches

COLEOPTERA

Chrysobothris sp.

(Buprestidae) One specimen reared from infested branches of tree, at
Santa Isabel, altitude 50 ft., Nov. 15, 1940. (LFM.)

Corticeus sp.

(Tenebrionidae) Beetles reared from dry branches of tree, at Santa
Isabel, June 20, 1941. (LFM.)

Heterarthron gonagrum (Fabricius)

(Bostrychidae) Reared from dry branches of tree, at Santa Isabel,
altitude 50 ft., June 20, 1941. (LFM.)

Xylomeira torquata (Fabricius)

(Bostrychidae) Reared from dry branches of tree, at Santa Isabel,
June 20, 1941. (LFM.)

Lepturges guadeloupensis Fleutiaux & Sallé

(Cerambycidae) Reared from dry branch of tree, at Santa Isabel,
June 20, 1941. (LFM.)

Stephanoderes sp.

(Scolytidae) Reared from dry branch of tree, at Santa Isabel, June 20,
1941. (LFM.)

Capparis indica (L.) Fawc. & Rendle

(Capparidaceae)

DISTRIBUTION: A shrub or a small tree, growing in thickets, woods and
hillsides at lower elevations, in the eastern and southern districts of Puerto

Capparis

Rico; Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda; Jamaica and from St. Barts to Barbados. Also in continental tropical America.

COMMON NAMES: "Linguam."

INSECT RECORDS

Insects Affecting the Leaves

HEMIPTERA***Corythucha gossypii* (Fabricius)**

(Tingitidae) Nymphs and adults abundant on the undersides of leaves. Many trees infested at Sardinero Beach, Mona Island, April 5, 1944. (LFM.)

Capparis portoricensis Urban

(Capparidaceae)

DISTRIBUTION: A tree, growing in woods and thickets, in the dry southwestern districts of Puerto Rico, at lower elevations. Also at Vieques, St. Jan and Dominica.

USES: The wood is nearly white, rather hard and heavy. It is of no use, locally.

COMMON NAMES: "Burro" and "Burro blanco."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA***Ascia monuste* (Linnaeus)**

(Pieridae) Reared from eggs laid on tender shoots of trees. Larvae voracious feeders, destroying large part of the foliage. Pupation period 7 days. Altitude ranging from 1,500 to 2,000 ft., Cayey, Dec. 24, 1940. (LFM.)

Capparis

Dichogamma redtenbackeri Lederer

(Pyraustidae) Adults reared, from caterpillars webbing leaves of trees, at Salinas, altitude 800 ft., Dec. 24, 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels and large nest on trunks of large trees. at Salinas, Oct. 24, 1941. (LFM.)

Casearia

Casearia aculeata Jacq.

(Flacourtiaceae)

DISTRIBUTION: A shrub or a small tree, growing in thickets, woods and on hillsides at lower and middle elevations, in the southern and western districts of Puerto Rico. Also recorded from Jamaica, Cuba, Hispaniola, and continental tropical America.

COMMON NAME: "Cambrón."

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA

Crypticerya rosae (Riley & Howard)

(Coccidae) At Ponce (IB:119).

Casearia arborea (L. C. Rich.) Urban

(Flacourtiaceae)

DISTRIBUTION: A tree, growing in woodlands and forests in wet or moist

Casearia

districts of Puerto Rico, ascending to 1,000 meters in altitude. Also recorded from St. Thomas, Cuba, Hispaniola and northeastern South America.

COMMON NAMES: "Rabo de ratón," "Gía verde" and "Rabojunco."

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA

Howardia biclavis (Comstock)

(Coreidae) Listed (IB:134), 1913.

Casearia decandra Jacq.

(Flacourtiaceae)

DISTRIBUTION: A shrub or tree, growing in woods, thickets and on hill-sides, mostly in wet or moist districts of Puerto Rico, ascending to middle or higher elevations. Recorded also from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, St. Martin, from Saba to Trinidad, Margarita and northern South America.

COMMON NAMES: "Gía mansa," "Caracolillo," "Palo blanco," "Cereza," "Cotorrerillo," "Coreho blanco," Wild honey tree and Wild cherry.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on the trunk of a large tree at Guajataca Gorge, near Quebradillas, Nov. 17, 1940. (LFM.)

Casearia*Casearia sylvestris* Sw.

(Flacourtiaceae)

DISTRIBUTION: A shrub or tree, growing in woods, forests, thickets, and on hillsides, at lower and middle elevations, in wet or moist districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Jamaica, Cuba, Hispaniola, from St. Martin to Trinidad and continental tropical America.

COMMON NAMES: "Laurel espada," "Cafeillo cimarrón" and "Sarna de perro."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA***Icerya montserratensis*** Riley & Howard

(Coccidae) Listed (IB:119).

LEPIDOPTERA***Oiketicus kirbyi*** Guilding

(Psychidae) One bag worm feeding on the foliage of a small tree, at Río Piedras, Dec. 15, 1941. (LFM.)

Cassia*Cassia fistula* L.

(Caesalpiniaceae)

DISTRIBUTION: A tree, growing along roadsides, in pastures and on hillsides, in Puerto Rico. Also recorded from Vieques, St. Croix, Cuba, Jamaica and Hispaniola. A species native to tropical Asia.

USES: The wood is reddish, hard, strong and durable. It has a specific gravity of about .93 and is used for posts, agricultural implements and general house construction. The purgative pulp of the fruit or pod, yields a drug.

Cassia

COMMON NAMES: "Cañafistula," "Cañafistulo," Golden shower, Indian laburnum and Purging Cassia.

INSECT RECORDS**Insects Affecting the Leaves****LEPIDOPTERA****Erebus odora** (Linnaeus)

(Phalaenidae) The caterpillar feeding, on the foliage of trees, according to Mr. Van Zwaluwenburg (IB:434).

Gynaecia dirce (Linnaeus)

(Nymphalidae) According to Möschler, the caterpillar feeds on the foliage of tree. (Listed as *Cassia fistulosa* in Möschler, p. 97.)

Insects Affecting the Branches and Twigs**HOMOPTERA****(Coccidae)****Asterolecanium pustulans** (Cockerell)

One of the worst pests of this tree, causing considerable injuries and often the death of young as well as large trees. At Barceloneta, (IB:122) 1923. Trees near Quebradillas, infested by this scale insect, June 1941. (LFM.)

Howardia biclavis (Comstock)

At Aguirre, (IB:135), 1916.

HYMENOPTERA**Alaptus borinquensis** Dozier

(Mymaridae) Reared from *Asterolecanium pustulans* (Cockerell) on trees, May 1925, (IB:519).

Marietta busckii (Howard)

(Alphelinidae) Reared from *Asterolecanium pustulans* (Cockerell) on trees, (IB:528), 1925.

Euaphycus portoricensis Dozier

(Encyrtidae) Reared from *Asterolecanium pustulans* (Cockerell) on trees, (IB:530).

Cassia

Cassia nodosa Hamilt.

(Caesalpiniaceae)

DISTRIBUTION: A tree native to the Chittagong tropical forests of the north of Upper Burma and the Andamans. Introduced into Puerto Rico.

USES: Grown in gardens and "patios" as an ornamental.

COMMON NAMES: "Casia rosada," Pink casia and Red and pink shower.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Acrobasis crassisquamella Hampson

(Phycitidae) Caterpillars folding leaves. Two adults reared by Mr. Seín, Río Piedras, Feb. 1944. Det.: Mr. Carl Heinrich (J. A. Bonnet, Coll.).

Castilla

Castilla elastica Cerv.

(Moraceae)

DISTRIBUTION: An introduced tree, occasionally planted in Puerto Rico. Native of the lowland forests of Mexico and Honduras.

USES: The milky sap of the tree, contains caoutchouc or rubber and is the main source of the Central American rubber. The wood is pale brown, light, fairly soft, not strong, thus not utilized. The large tree has been recommended as a suitable shade tree for coffee and cacao.

COMMON NAMES: "Goma," "Palo de goma" and Rubber tree.

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA

Howardia biclavis (Comstock)

(Coccidae) At Bayamón (IB:135), 1916.

Castilla

Insects Affecting the Leaves

LEPIDOPTERA**Pachylia ficus** (Linnaeus)

(Sphingidae) Caterpillar feeding on the foliage of tree, (IB:448)
(Wolcott, 1914).

Casuarina*Casuarina equisetifolia* Forst.

(Casuarinaceae)

DISTRIBUTION: An introduced tree, locally spontaneous after planting along the coasts in Puerto Rico, St. Thomas, and St. Croix. More or less naturalized in Florida, Cuba, Jamaica, Hispaniola and Yucatán. Native to Australia.

USES: Much planted for ornament, hedges and windbreaks; valued for its wood which is used for ox-cart tongues, posts and beams (not underground); also it is an excellent timber for fuel and charcoal.

COMMON NAMES: "Casuarina," "Pino australiano," "Pino," Beef wood, Australian pine and She-wood.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA**Artipus monae** Wolcott

(Curculionidae) Adults abundant on the foliage of trees, at Mona Is. (SIB:102), 1939. (LFM.)

Sitophilus oryza (Linnaeus)

(Curculionidae) At Guánica (IB:316), 1914. Probably the adults feeding on the foliage.

LEPIDOPTERA**Oiketicus kirbyi** Guiding

(Psychidae) On host tree at Arecibo; at Mona Island, 1939, (SIB:137). The caterpillars feeding on the foliage. (LFM.)

Casuarina

Insects Affecting the Branches and Twigs

HOMOPTERA

(Coccidae)

Crypticerya rosae (Riley & Howard)

At the base of a young shoot, a single scale or coccid collected, June 1, 1912, at Guánica.

Icerya montserratensis Riley & Howard

At Isabela, (IB:120), 1934. At Mayaguez, (SIB:56), 1940.

Icerya purchasii Maskell

For first time reported on trees, at Puerta de Tierra, near San Juan, June 1932; also at Bayamón and Dorado, during 1932-34, (IB:120-21). Since that date recorded from many localities and considered a pest of Australian pines. At Manatí, Trujillo Alto, Arecibo, Camuy, Guajataca, Isabela, Río Grande, Mayaguez, Guánica and Mona Is., (SIB:56). (LFM.)

Howardia biclavis (Comstock)

At Arecibo, listed (IB:135).

COLEOPTERA

Decadiomus pictus Chapin

(Coccinellidae) Larvae predaceous on *Icerya purchasii* Maskell, infesting trees, at Dorado, (IB:228), 1932.

HYMENOPTERA

Solenopsis geminata (Fabricius)

(Formicidae) Attending cottony cushion scales, *Icerya purchasii* Maskell, on trees, at Mona Is., (SIB:149). (LFM.)

Dorymyrmex pyramicus var. **niger** Pergande

(Formicidae) Attending cottony cushion scales, *Icerya purchasii* Maskell, on trees, at Mona Is., (SIB:150). (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) **costalis** (Holmgren)

(Termitidae) Several large trees, at the main entrance to Central Los Caños, Arecibo, infested with nests and tunnels. May 21, 1941,

Casuarina

altitude 100 ft. Also large nest on tree, at Hipódromo Las Monjas, Hato Rey, near sea-level, May 25, 1941. (LFM.)

HOMOPTERA***Crypticerya rosae* (Riley & Howard)**

(Coccidae) Infesting trunks of trees, at Ponce and Guánica (SIB:56), 1936-39. Observed also on trees at Guánica Insular Forest, on May 22, 1940. (LFM.)

COLEOPTERA***Chrysobothris tranquebarica* (Gmelin)**

(Buprestidae) Larvae, presumably of this species, attacking trees at Vega Baja (IB:215). (GNW.)

***Tenebroides* sp.**

(Ostomidae) Collected at Guánica, on the pupal stage, from a pupal cell of the cerambycid, *Cylindera flava* (Fabricius), April 18, 1940. (D. DeLeón) (LFM.).

***Bothrideres dentatus* Chevrolat**

(Colydiidae) Fairly common species under the bark of trees, at Guánica, April 1940 (D. DeLeón & Martorell).

***Gnathocerus maxillosus* (Fabricius)**

(Tenebrionidae) An adult collected on host tree at Guánica, April 15, 1940 (D. DeLeón) (LFM.).

***Apate monachus* Fabricius**

(Bostrychidae) Females attacking young trees 4 years old, at Guayanilla, (SIB:235), 1937. (LFM.)

***Chlorida festiva* (Linnaeus)**

(Cerambycidae) Larvae in casuarina fence posts at Naguabo (SIB:98), 1939.

***Elaphidion nanum* (Fabricius)**

(Cerambycidae) Larvae of this species associated with larvae of *Cylindera flava* (Fabr.) mentioned below, breeding in trunks, at Guánica Insular Forest, April 18, 1940. (DeLeón & Martorell.)

***Cylindera flava* (Fabricius)**

(Cerambycidae) Adults, larvae and pupae were collected from logs of trees, at Guánica, April 26 and 27, 1940. The larvae of a saffron

Casuarina

yellow color, work between the wood and the bark, later pupating under the bark. (D. DeLeón & Martorell.)

DIPTERA

Syneura cocciphila Coquillett

(Phoridae) Reared from *Crypticerya rosae* (Riley & Howard) on trunk of trees, at Ponce, (SIB:115), 1937. (GNW. & LFM.)

LEPIDOPTERA

Noropsis hieroglyphica (Cramer)

(Phalaenidae) Larvae boring in trunk of trees, causing severe injury, at Guánica, 1923 (IB:435).

Cecropia

. *Cecropia peltata* L.

(Moraceae)

DISTRIBUTION: A tree, growing on hillsides, in forests and ravines, in moist and wet districts of Puerto Rico, ascending to at least 900 meters. Also recorded from Vieques, St. Thomas, St. Croix, St. Jan, Cuba, Jamaica to Trinidad and northern South America.

USES: The branches are hollow, the old trunks solid, the soft wood nearly white. It is used for rafts, fuel and charcoal. The inner bark of the tree supplies a useful fiber.

COMMON NAMES: "Yagrumo," "Grayumo," "Guarumbo," "Sarumba" (Mexico), Trumpet tree and Trumpet wood.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Aphis gossypii Glover

(Aphididae) At Lares (IB:113), 1932.

Cecropia**COLEOPTERA****Prepodes** sp.

(Curculionidae) A beautiful greenish-blue curculionid, collected on a tender leaf, at Maricao Insular Forest, altitude 2,200 ft., May 31, 1942. (det.: Buchanan) (LFM.).

Compsus maricao Wolcott

(Curculionidae) Adult feeding on leaf, at Doña Juana Camp, altitude 1,900 ft., Villalba, 1940. (LFM.)

LEPIDOPTERA**Gynaecia dirce** (Linnaeus)

(Nymphalidae) According to Möschler, p. 97, the caterpillar of this species, lives on the foliage of tree. (IB:399). Sixteen caterpillars were collected feeding on the leaves of *Cecropia*, at El Yunque Mts., 2,500 ft. high, Nov. 30, 1944. Reared to adults. (LFM.) Det.: W. P. Comstock.

Historis odius (Fabricius)

According to Möschler, p. 98, the caterpillar of this species, lives on *Cecropia*, also specifying that they are not very abundant. The larva has been described by Mr. E. G. Smyth, collected on tree, (IB:400-401), 1920.

Correbidia terminalis (Walker)

(Amatidae) According to Dr. Gundlach, the caterpillar lives on the undersides of the *Cecropia* leaves. (IB:414.)

Sylepta silicalis (Guenée)

(Pyraustidae) Larvae feeding on buds at terminal of branches, causing considerable damage. Collected on El Yunque Mts., Mt. Britton trail, about 1,900 ft., in altitude. (det.: Heinrich) (LFM.).

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Large trees infested at Río Abajo Plantations, Utuado, altitude 1,200 ft., April 20, 1941. Also trees infested at Quebradillas, Arecibo, Lares, El Yunque Mts., altitudes up to 1,200 ft., June 16, 1940. (LFM.)

Cedrela*Cedrela mexicana* Roem.

(Meliaceae)

DISTRIBUTION: A very large tree, introduced and planted along roadsides and in different forest units of the island. A species very closely resembling our native species *C. odorata* L. Native of Central America and Mexico.

USES: Locally we do not have large and old enough trees to be used. In British Honduras, the fragrantly scented, durable, and easily worked timber, is used for dugout canoes and furniture, and is also exported for boat building and cigar box manufacturing.

COMMON NAMES: "Cedro," "Cedro hembra," Spanish cedar, Cedar and "Kulche" (Yucatán, Maya).

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA**Dikraneura cedrelae** Oman

(Cicadellidae) One of the worst pests of cedars, causing yellowing and heavy defoliation. At Yabucoa, Maunabo, Camp Doña Juana, (mountains north of Villalba), Aibonito, Maricao and Patillas. Ranging in altitudes from sea-level up to 2,000 ft. or more (LFM.). On Sept. 17, 1943, leafhoppers were found attacked by a fungus. Miss Vera K. Charles states: "The fungus on leafhoppers, *Dikraneura cedrelae*, is the fungus which I described as *Hirsutella verticillioides* on insects on rubber from Brazil. Dr. Petch, the English specialist on entomogenous fungi, has suggested that this species is the same as his *Cephalosporium fuliginosum*, but I have no material for comparison. However, I do not feel that the two organisms are identical. An ascogenous stage appears to be developing on the specimens and I would be very glad to have additional material should it become available at any time."

At Cayey, altitude 1,600 ft., Sept. 17, 1943. (LFM.)

COLEOPTERA**Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) Attacking the foliage of trees at Río Grande, (SIB: 103), 1940. Same injury at Cayey, on the mountain road to Salinas, 1,700 ft., altitude Dec. 30, 1940, eggs also found between leaves. During Feb. 1941, in the same locality an outbreak causing intense defoliation. Adults on the foliage of trees at Río Piedras, May 9, 1942. (LFM.)

Cedrela**LEPIDOPTERA****Cosmosoma auge** (Linnaeus)

(Amatidae) A beautiful, bright yellow cocoon found on cedar leaf, near El Peñón del Collao, altitude 1,800 ft., Cayey, Dec. 30, 1940. Moth reared. (LFM.)

Sabulodes sp.

(Geometridae) One moth reared from caterpillars feeding on the foliage of tree, near Peñón del Collao, altitude 1,800 ft., Dec. 30, 1940. Not very abundant. Presumably feeding on the foliage.

Insects Affecting the Twigs and Branches

HOMOPTERA

(Coccidae)

Pulvinaria psidii Maskell

Heavy infestation on trunk and branches, on trees 4 to 5 years old, at El Peñón del Collao 1,800 ft. altitude, Cayey, Feb. 5, 1941. (LFM.)

Ceroplastes cirripediformis Comstock

Few scale insects on twigs, at Cayey, altitude 1,700 ft., Dec. 30, 1940. (LFM.)

Saissetia oleae (Bernard)

On trees at Doña Juana Camp, in the mountains north of Villalba (SIB:60) 1940. At Cayey, a slight infestation on branches, few trees attacked, Oct. 13, 1940. Many branches of trees killed, at Cayey, near El Peñón del Collao, altitude 1,800 ft., Feb. 2, 1941. (LFM.)

Howardia biclavis (Comstock)

On dead branches of trees, completely covered by the scale insect, at El Verde, Río Grande, (SIB:60), 1940. (LFM.)

COLEOPTERA**Ambrosiodmus lecontei** Hopkins

(Scolytidae) Adults abundant, reared from dead branches and twigs of trees, at El Verde Plantation, Río Grande, May 1940. (D. DeLeón) (LFM.).

DIPTERA**Agromyza** sp.

(Agromyzidae) Small flies, whose larvae live in the young bark of

Cedrela

twigs and smaller branches, at El Peñón del Collao, Cayey, altitude 1,800 ft., June 20, 1940. (det: Greene) (LFM.).

LEPIDOPTERA**Hypsipyla grandella** (Zeller)

(Phycitidae) The worst pest of cedars in Puerto Rico. Heavy infestations on trees, in all sections of the island where the trees are planted. Recorded from Villalba, Yabucoa, Maricao, Aibonito, Cayey, Salinas, etc., ranging in altitude from sea-level to 2,000 ft. and up, 1937-42. (LFM.)

Calliephialtes sp.

(Ichneumonidae) An undescribed species, 2 females reared from caterpillars of *Hypsipyla grandella* (Zeller), found in bores, on twigs of tree, at El Peñón del Collao, Cayey, May 22, 1940, (det: Cushman). (LFM.)

Cedrela odorata L.

(Meliaceae)

DISTRIBUTION: A tree, growing in forests, river valleys, on hillsides and along streams in Puerto Rico. Also recorded from Jamaica and continental tropical America.

USES: The reddish brown, fragrant wood, now scarce, is used for cigar boxes, in carpentry, for furniture and various ornamental articles. It is soft, durable, rather strong, with a specific gravity of about 0.5.

COMMON NAMES: "Cedro," "Cedro hembra," West Indian cedar and Spanish cedar.

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA****Dikraneura cedrelae** Oman

(Cicadellidae) Causing yellowing of leaves and intense defoliation.

Cedrela

A pest of trees, at Yabucoa, Villalba, Aibonito, Maricao, Lares, Toa Alta, Patillas and Cayey (SIB:52), 1936-40. (LFM.)

COLEOPTERA**Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) At Río Grande (SIB:103), 1940. Adults feeding on the foliage of an old tree at Cayey, on the Salinas road, altitude 1,600 ft., March 1941. (LFM.)

Insects Affecting the Twigs

HOMOPTERA**Howardia biclavis** (Comstock)

(Coccidae) On twigs of trees, killing them, at El Verde, Río Grande (SIB:60), 1940. (LFM.)

LEPIDOPTERA**Hypsipyla grandella** (Zeller)

(Phycitidae) Becoming abundant during the Spring, at Doña Juana plantations, north of Villalba, (SIB:133), 1940. The worst pest of cedars in Puerto Rico, wiping out complete plantings. (LFM.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Large tree, about 30 ft. high and a trunk diameter of 12 inches, infested by termites, at Lares, altitude 1,270 ft., Dec. 10, 1941. Also trees infested at Guajataca, Aug. 15, 1941. (LFM.)

HOMOPTERA**Pulvinaria psidii** Maskell

(Coccidae) Great infestation on trunk of trees, at Cayey, on the Salinas road, altitude 1,700 ft., (SIB:58), 1939. (LFM.)

LEPIDOPTERA**Ecpantheria icasia** (Cramer)

(Aretiidae) Egg-mass on trunk of tree, at Doña Juana Camp, north of Villalba (SIB:125), 1940. (LFM.)

Ceiba*Ceiba pentandra* (L.) Gaertn.

(Bombacaceae)

DISTRIBUTION: A tree, growing in forests, on hillsides and river-banks at lower elevations in Puerto Rico; largest and most abundant in the dry southern districts. Also recorded from Vieques, St. Thomas, St. Croix, St. Jan, Cuba, Jamaica, Hispaniola, northern South America and the Old World tropics.

USES: Often planted for shade; the wooly seeds are used for stuffing pillows. The wood is soft, light brown, weak, light in weight, not durable in contact with the soil. It is used for boats, canoes, tubs, basins and in construction.

COMMON NAMES: "Ceiba," "Ceibo," Silk-cotton, Cotton tree, Kapok tree, Cork wood (Br. W. I.) and "Fromager" (Haiti).

INSECT RECORDS

Insects Affecting the Seeds

HEMIPTERA

Dysdercus andreae (Linnaeus)

(Pyrrhocoridae) Feeding on seeds of trees, on the ground, at Salinas, (IB:164), 1924.

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) At Loiza (IB:298). Heavy defoliation caused by adults, near Salinas, on the Cayey road, altitude 1,300 ft., Oct. 8, 1940. Few days later Oct. 15, an outbreak at Salinas, many trees attacked. Eggs collected between the leaves. At Naguabo, very large tree, totally defoliated by adults, altitude 250 ft., May 27, 1941. (LFM.)

LEPIDOPTERA

Brachycorene arcas (Drury)

(Hesperiidae) Larva feeding on leaves of host tree, near Peñón del Collao, altitude 1,700 ft., Cayey-Salinas Rd., Oct. 24, 1940. Larva identified by G. N. Wolcott. No adult emerged. (LFM.)

Oiketicus kirbyi Guilding

(Psychidae) Defoliating small trees at Laguna de San José, (IB:502), 1935.

Ceiba**Bucculatrix** sp.

(Tineidae) Injury to the foliage by very small caterpillars from which minute moths were reared. Pupation in long, ribbed, white silken cocoons, attached to the midrib, on undersides of leaves, at Aguadilla, 1940. (Wolcott & Martorell.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N) costalis** (Holmgren)

(Termitidae) Nest and tunnels on large tree at Aguadilla, Sept. 4, 1940. Also at Ponce, May 1941. (LFM.)

Cestrum*Cestrum diurnum* L.

(Solanaceae)

DISTRIBUTION: A shrub, growing on banks and along roadsides at lower elevations, in Puerto Rico. Probably an introduced species, recorded also from Jamaica, Cuba, Cayman Islands, Hispaniola, Mexico and Florida (after introduced).

USES: Grown locally in gardens, as an ornamental.

COMMON NAME: "Dama de día."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA**Monobelus fasciatus** (Fabricius)

(Membracidae) At Guajataca, near the Lake, (SIB:50), 1938. (GNW. & LFM.)

Aleurodicus minimus Quaintance

(Aleyrodidae) Listed (IB:145).

Cestrum*Cestrum laurifolium* L'Her.

(Solanaceae)

DISTRIBUTION: A shrub, growing in thickets, woods and on hillsides, at lower and middle elevations, mostly in wet or moist districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Jan, St. Thomas, Tortola, Virgin Gorda, Cuba, Hispaniola, and from Saba to Trinidad.

COMMON NAME: "Galán del monte."

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA**Howardia biclavis** (Comstock)

(Coccidae) Many twigs killed on account of the heavy infestation of the scale insect, at Aibonito, March 9, 1941, at more than 2,000 ft. in altitude. (LFM.)

Chione*Chione venosa* (Sw.) Urban

(Rubiaceae)

DISTRIBUTION: A tree, growing in woods and on hillsides in moist or wet districts, ascending to higher elevations in Puerto Rico. Also recorded from St. Croix, St. Thomas, Tortola, Hispaniola, from Montserrat to Tobago and British Guiana.

USES: The tree is not very abundant in the island, thus very little is known about its properties and uses. However, in the past, it has been used for lumber.

COMMON NAMES: "Martín Avila," "Santa Olalla," and "Palo blanco."

INSECT RECORDS

Insects Affecting the Twigs or Leaves

HOMOPTERA**Orthezia insignis** Douglas

(Coccidae) Listed (SIB :56).

Chlorophora

Chlorophora tinctoria (L.) Gaud.

(Moraceae)

DISTRIBUTION: A tree, growing in woodlands and on hillsides, in Puerto Rico. Also recorded from Mona, Vieques, St. Thomas, St. Croix, St. Jan, Cuba, Jamaica, Trinidad, Curacao and continental tropical America.

USES: The hard, strong, durable, yellowish wood is used for furniture and in construction. The tree yields a valuable dye.

COMMON NAMES: "Mora," "Palo de mora," and Fustic.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Timetes chiron (Fabricius)

(Nymphalidae) According to Möschler, p. 98, the caterpillar of this butterfly feeds on the leaves of this tree. (IB:400.)

Chrysobalanus

Chrysobalanus icaco L.

(Amygdalaceae)

DISTRIBUTION: A tree or shrub, growing in thickets and on hillsides, mostly at lower elevations near the coasts, in Puerto Rico, Icacos, Vieques, St. Thomas, St. Croix, St. Jan and Tortola. Also recorded from Florida, Cuba, Jamaica, Hispaniola, from Mexico to northern South America and tropical Africa.

USES: The light brown wood, hard and heavy, and with a specific gravity of about 0.77, is not used locally. The leaves and bark are astringent; the fruit is used for "dulces" or preserves; the seeds are edible and yield an oil.

COMMON NAMES: "Hicaco" and Coco-plum.

INSECT RECORDS

Insects Affecting the Fruits

DIPTERA

Anastrepha unipuncta Sefn

(Tephritidae) Reared from fruits, at Bayamón, listed (SIB:120).

Chrysobalanus

LEPIDOPTERA

Ephestia cautella (Walker)

(Phycitidae) At Bayamón (SIB:133). Listed as "prob." *cautella*.

Platynota rostrana (Walker)

(Tortricidae) From the fruits (SIB:134).

Insects Affecting the Leaves

HOMOPTERA

Joruma neascripta Oman

(Cicadellidae) On tree, at Manatí (SIB:52). Presumably on the foliage.

COLEOPTERA

Exophthalmodes roseipes (Chevrolat)

(Curculionidae) At Punta de Cangrejos (IB:293), 1922. Listed as *Prepodes roseipes* Chevrolat.

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) At Punta Cangrejos, many records, years 1913 to 1915; eggs of weevil between leaves of trees, 1914. (IB:298-99.)

HYMENOPTERA

Sterictiphora krugii (Cresson)

(Tenthredinidae) Larvae feeding on foliage of trees, according to Mr. Van Zwaluwenburg. (IB:509).

Insects Resting on the Tree

THYSANOPTERA

Selenothrips rubrocinctus (Giard)

(Thripidae) At Trujillo Alto, listed (IB:65).

HOMOPTERA

Nessorhinus vulpes Amyot & Serville

(Membracidae) At Arecibo (IB:74).

Ormenis quadripunctata (Fabricius)

(Fulgoridae) At Joyuda (SIB:53).

COLEOPTERA

Cryptocephalus nigrocinctus Suffrian

(Chrysomelidae) At Punta Salinas (IB:267), 1923.

Chrysophyllum*Chrysophyllum argenteum* Jacq.

(Sapotaceae)

DISTRIBUTION: A tree, growing in woodlands, forests and on hillsides, at lower and middle elevations in wet or moist districts of Puerto Rico. Recorded also from St. Thomas, Tortola, Cuba, Hispaniola and from Saba to Trinidad.

COMMON NAME: "Caimito verde."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Icerya montserratensis Riley & Howard

(Coccidae) Listed in (IB:120).

Pseudococcus nipae (Maskell)

(Coccidae) (IB:127), 1912. Infestation on the undersides of foliage of trees, at Guajataca, altitude 300 ft., Nov. 17, 1940. (LFM.)

Chrysophyllum cainito L.

(Sapotaceae)

DISTRIBUTION: A tree, growing in forests and on hillsides in Puerto Rico. Also recorded from St. Croix, St. Thomas, Jamaica, Cuba, Hispaniola, from St. Kitts to Trinidad and continental tropical America.

USES: The red-brown wood is hard, heavy, strong, tough and durable, and is used in construction. Its edible fruit is highly esteemed.

COMMON NAMES: "Caimito," "Cainito," "Caimito morado," Cainit and Star apple (Br. W. I.).

INSECT RECORDS

Insects Affecting the Fruits

Anastrepha unipuncta Seín

(Tephritidae) Reared from the fruit (IB:378).

Chrysophyllum

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Pulvinaria psidii Maskell

Listed (IB:128).

Howardia biclavis (Comstock)

Listed (IB:134), 1912.

Selenaspidus articulatus (Morgan)

At Garrochales (IB:139), 1916. Listed as *Pseudaonidia articulatus* Morgan.

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Eggs laid between leaves of trees, at Camuy, (SIB: 103), 1936. (GNW. & LFM.)

Chrysophyllum pauciflorum Lam.

(Sapotaceae)

DISTRIBUTION: A tree, growing on hillsides at lower elevations in the dry southern districts of Puerto Rico. Also recorded from Vieques, St. Jan, St. Thomas, and St. Croix. Endemic.

COMMON NAME: "Caimito de perro."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Oiketicus kirbyi Guilding

(Psychidae) One bag worm collected, while feeding on the foliage of a tree, at Guajataca Hills, altitude 120 ft., Nov. 17, 1940. (LFM.)

Cicca*Cicca disticha* L.

(Euphorbiaceae)

DISTRIBUTION: A tree, planted along roadsides and waste grounds, spontaneous after planting in Puerto Rico. Also recorded from St. Thomas, St. Croix, St. Jan, and Tortola. Perhaps a native of the East Indies.

USES: The tough, strong and durable wood is not used locally. Planted for its fruit, which is used in the preparation of preserves or jellies.

COMMON NAMES: "Cereza amarilla," "Grosella," "Grosella blanca," "Cerezas" and Otaheite gooseberry.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA**Melanchroia cepise** (Cramer)

(Geometridae) Van Zwaluwenburg reports, "a local outbreak at Camuy, where the larvae practically stripped the host trees," (IB:453).

HOMOPTERA**Pseudococcus virgatus** (Cockerell)

(Coccidae) At Santurce, listed (IB:128), 1933.

Coccus hesperidum Linnaeus

(Coccidae) Listed, (IB:131), 1933.

HYMENOPTERA**Pseudaphycus** sp.

(Encyrtidae) Reared from *Pseudococcus virgatus* (Cockerell), infesting trees at Santurce, (IB:529), 1933.

Cinnamomum*Cinnamomum zeylanicum* Nees

(Lauraceae)

DISTRIBUTION: A tree, occasionally planted in Puerto Rico and the Virgin Islands. Native to Southern Asia.

Cinnamomum

USES: The bark which is used as a spice, yields by distillation the cinnamon oil. A fragrant wax is obtained from the ripe fruits and a volatile oil is also the product of distillation of the bark, leaves, fruits and young shoots. Locally the tree has no use.

COMMON NAMES: "Canela," "Palo de canela," "Canela legítima" and Cinnamon.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Coccus mangiferae (Green)

(Coccidae) Listed in (IB:131).

Citharexylum

Citharexylum caudatum L.

(Verbenaceae)

DISTRIBUTION: A shrub or tree, growing in the mountain forests at middle and higher elevations in Puerto Rico. Also recorded from the Bahamas, Jamaica, Cuba, Hispaniola and Mexico.

COMMON NAMES: "Higüerillo" and "Péndula."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Pyrausta cerata (Fabricius)

(Pyraustidae) Larvae infesting trees at Carite Insular Forest, near Cayey, 2,000 ft. in altitude and at El Yunque Mts., in the Luquillo National Forest, at 1,800 ft. altitude, Sept. 1940. Also caterpillars webbing leaves, on young trees, at Cerro de Punta, Jayuya, altitude 3,600 ft., Jan. 26, 1941. (LFM.)

Citharexylum*Citharexylum fruticosum* L.

(Verbenaceae)

DISTRIBUTION: A tree, growing in woods, thickets and on hillsides, at lower and middle elevations, in Puerto Rico. Also recorded from Desecheo, Icacos, Culebra, Vieques, St. Thomas, St. Croix, St. Jan, Tortola, Virgin Gorda, Anegada, Florida, Bahamas, Cuba, Jamaica, Hispaniola, Guadeloupe and Dominica.

USES: Its red wood is hard and strong, with a specific gravity of about .87, and is used for furniture and in construction.

COMMON NAMES: 'Péndula,' 'Péndola,' 'Péndula colorada,' 'Palo de guitarra,' 'Bálsamo,' 'Higüerillo,' 'Péndulo colorado,' 'Fiddle wood' and Old woman's bitter.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA**Agathodes designalis** Guenée

(Pyraustidae) Listed in (IB:463), 1917.

Pyrausta cerata (Fabricius)

(Pyraustidae) Abundant on host trees at Aibonito and Trujillo Alto, (IB:467), 1923. Caterpillars abundant on trees at Yabucoa, Maunabo, Cayey, Bayamón, Isabela, Aguadilla, Cabo Rojo, Guánica (1937), Maunabo, Patillas, Isabela, San Sebastián and other localities (SIB:131), 1937-40. Eggs of moth, collected on leaves of host tree, at San Sebastián, Nov. 25, 1940. Adults reared from these eggs. (LFM.)

Acrocercops inconspicua Forbes

(Gracilariidae) Larva a leaf miner on trees, listed (IB:499).

Insects Affecting the Twigs

HOMOPTERA

(Fulgoridae)

Colpoptera maculata Dozier

Listed, at Salinas (IB:99).

Ormenis quadripunctata (Fabricius)

Particularly abundant on trees, near Salinas, (IB:103).

Citharexylum

Flatoides punctata (Walker)

Near Salinas, (IB:105).

(Coccidae)

Pulvinaria psidii Maskell

On twigs and petioles (IB:128), 1923.

Coccus viridis (Green)

Large infestation on old tree, many twigs killed on account of scale insect, at Patillas, March 11, 1941, altitude 100 ft. (LFM.)

Ischnaspis longirostris (Signoret)

At Naguabo, listed (IB:143), 1914.

Clibadium

Clibadium erosum (Sw.) DC.

(Carduaceae)

DISTRIBUTION: A shrub or tree, growing in the mountain forests, at the eastern and central districts of Puerto Rico. Also recorded from Saba, St. Kitts, Montserrat, Guadeloupe, Dominica, Martinique and St. Thomas.

COMMON NAME: "Turma de toro."

INSECT RECORDS

Insects Affecting the Trunk

HOMOPTERA

Pseudaulacaspis pentagona (Targioni)

(Coccidae) Small tree, with trunk as well as branches, totally covered by this whitish scale insect. El Yunque Mts., near the Recreational Area, 1,500 ft. altitude, Sept. 23, 1940. (LFM.)

Clusia

Clusia rosea Jacq.

(Clusiaceae)

DISTRIBUTION: A tree, growing in woods, on hillsides and river-banks, mostly at lower elevations, in Puerto Rico. Also recorded from Mona, Desecheo, Vieques, Culebra, St. Croix, St. Thomas, St. Jan, Tortola, Cuba, Jamaica, Hispaniola and continental tropical America.

USES: The reddish brown wood is hard and durable, with a specific gravity of about 0.8. It is used for railroad ties, fence posts, fuel and in general construction.

COMMON NAMES: "Cupey," "Palo de cupey," Pitch Apple, Wild mamee and Scotch Lawyer (Trinidad) and Balsam tree (Br.W.I.).

INSECT RECORDS**Insects Attacking the Trunk****ISOPTERA**

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest on tree, at Isabela, (SIB:43), 1940. Large tree at Guajataca, with nest and tunnels on the trunk, Oct. 24, 1940. (LFM.)

COLEOPTERA

Elaphidion tomentosum Chevrolat

(Cerambycidae) Larva in trunk of tree, (IB:260), 1933.

Coccolobis

Coccolobis grandifolia Jacq.

(Polygonaceae)

DISTRIBUTION: A tree, growing in the forests at middle and higher elevations at the western districts of Puerto Rico. Also recorded from Hispaniola, Barbuda, Antigua, Guadeloupe, Montserrat, Martinique, Barbados, Mexico and Guianas.

Coccolobis

USES: The red, hard and durable wood, was highly prized for building purposes, furniture and cabinet work, but now is very scarce.

COMMON NAME: "Moralón."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Attelabus coccolobae Wolcott

(Curculionidae) At Maricao, (SIB:102), 1940. (LFM.)

HYMENOPTERA

Sterictiphora krugii (Cresson)

(Tenthredinidae) Listed (SIB:138), 1940. (LFM.)

· *Coccolobis laurifolia* Jacq.

(Polygonaceae)

DISTRIBUTION: A tree, growing in thickets and woodlands, at lower elevations, mostly in dry districts of Puerto Rico. Also recorded from Vieques, Mona, St. Croix, Florida, Bahamas, Jamaica, Cuba and Hispaniola.

USES: The reddish brown wood is hard, very heavy, its specific gravity about 1.00.

COMMON NAMES: "Uvillo," "Gateado," "Cucubano," "Uverillo," "Glateado" and "Uvilla."

INSECT RECORDS

Insects Affecting the Leaves

ORTHOPTERA

Microcentrum triangulatum Brunner

(Tettigoniidae) About 25 eggs laid in a row around the edge of a leaf, at Guajataca, Nov. 17, 1940, altitude 30 ft. (LFM.)

Coccobius**HOMOPTERA**

(Coccidae)

Pseudococcus nipae (Maskell)

Infestation on the undersides of leaves, at Guajataca, Quebradillas, altitude 30 ft., Nov. 17, 1940. (LFM.)

Vinsonia stellifera (Westwood)

Listed, (IB:130), 1914.

Coccus viridis (Green)

On the undersides of leaves and on twigs, at Mona Island, (SIB:59), 1939. (LFM.)

COLEOPTERA**Attelabus coccobae** Wolcott

(Curculionidae) At Guánica, (SIB:102), 1940. Many trees attacked at Guajataca Gorge, near Quebradillas, altitude 20 ft., Oct. 24, 1940. (LFM.)

HYMENOPTERA**Sterictiphora krugii** (Cresson)

(Tenthredinidae) At Maricao Insular Forest (SIB:138), 1940. At Quebradillas, infesting many trees; larvae, adults and eggs very abundant on the foliage of trees. Oct. and Nov. 1940. (LFM.)

Insects Affecting the Branches and Twigs**HOMOPTERA****Ormenis marginata** (Brunnich)

(Fulgoridae) On branches and twigs, breeding, adults and nymphs abundant, at Mona Island, (SIB:53), 1940. (LFM.)

Ormenis pygmaea (Fabricius)

On twigs and branches, but not so abundant as *O. marginata* (Brunnich). Numerous nymphs and adults, on the twigs, sometimes going to the undersides of leaves, (SIB:53), 1940. (LFM.)

Ormenis quadripunctata (Fabricius)

At Mona Island, (SIB:53), 1940. (LFM.)

Coccus viridis (Green)

(Coccidae) On twigs of trees, infestation extending up to the undersides of leaves, at Mona Island, (SIB:53), 1940. (LFM.)

Coccolobis

ISOPTERA

Kalotermes (K.) snyderi Light

(Kalotermitidae) Infesting the dead branches of live trees, abundant.
Mona Island, April 5, 1944. (GNW. & LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trunk of medium sized tree, at Guajataca,
Nov. 17, 1940; also at El Vigía, Arecibo, Dec. 1, 1940. (LFM.)

Insects Resting on the Tree

THYSANOPTERA

Selenothrips rubrocinctus (Giard)

(Thripidae) At Dorado, (SIB:40). Possibly on the foliage.

HEMIPTERA

Sphictyrtus whitei (Guérin-Ménéville)

(Coreidae) Adults on tender leaf, possibly feeding; at top of cliff on
Mona Island. (SIB:76), 1939. (GNW.)

Coccolobis pirifolia Desf.

(Polygonaceae)

DISTRIBUTION: A tree, growing in woodlands and on hillsides, ascending into the mountain forests at higher elevations, in wet or moist districts of Puerto Rico. Also recorded from St. Thomas and Jamaica.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Chrysomphalus sp.

(Coccidae) On leaves and twigs, at the Maricao Insular Forest, about 1,900 ft. high, (SIB:333), 1917. (LFM.)

Coccolobis**DIPTERA****Cecidomyia coccolobae** (Cook)

(Itonididae) From small cone-shaped galls on the leaves of trees, (IB:333), 1917.

HYMENOPTERA**Sterictiphora krugii** (Cresson)

(Tenthredinidae) Eggs, adults and caterpillars on the foliage of several trees, at Carite Unit Mts., altitude 2,500 ft., May 17, 1940. (LFM.)

Coccolobis uvifera (L.) Jacq.

(Polygonaceae)

DISTRIBUTION: A tree, growing in coastal thickets and on hillsides near the coasts in Puerto Rico. Also recorded from Icacos, Culebra, Vieques, Mona, Desecheo, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Anegada, Florida, Bermuda, Cuba, Jamaica, Hispaniola, and continental tropical America.

USES: The heavy, hard, dark brown wood, having a specific gravity of about 0.96, is used for furniture and cabinet work. The fruits are used for making jelly and in the preparation of an alcoholic drink.

COMMON NAMES: "Uva," "Uva de playa," "Uva de mar," "Uvero," Sea grape and Pigeon wood. (Jamaica.)

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

(Aphiidae)

Aphis rumicis Linnaeus

At Ponce, listed (IB:116).

Toxoptera aurantii (Fonscolombe)

At Punta Salinas, attended by *Monomorium destructor* (Jerdon), (IB:117), 1922.

Coccolobis

(Coccidae)

Pseudococcus nipae (Maskell)

Listed (IB:126).

Coccus viridis (Green)

On leaves and twigs of trees, at Mona Island, (SIB:59), 1939. (LFM.)

Chrysomphalus (Melanaspis) portoricensis (Lindinger)

At Luquillo, (SIB:61), 1940. Also observed at Río Piedras, on seedlings brought from Luquillo, June 30, 1944. (GNW.)

Aspidiotus lataniae Signoret

On the undersides of leaves, at Quebradillas, Jan. 1945. (GNW.)
Det: H. Morrison.

(Aleyrodidae)

Aleurothrixus floccosus (Maskell)

Infested trees, controlled by the parasitic wasp, *Eretmocerus portoricensis* Dozier, listed (IB:146). On the undersides of leaves, Mona Island, April 7, 1944. (GNW.) (Det: Russell).

Aleurotrachelus sp.

On leaves of trees, at Quebradillas, (SIB:63), 1938-39. Slight infestation on young leaves, on trees at cliff near the coast, at Isabela, 200 ft. altitude, Sept. 10, 1941. (GNW. & LFM.)

HEMIPTERA

Jadera rubrofusca Barber

(Coreidae) At Dorado, (IB:174).

COLEOPTERA

Phyllophaga portoricensis (Smyth)

(Scarabaeidae) Adults feeding on leaves, in mid-April, no rain (SIB:91), 1938. (GNW.) Feeding on tender leaves of trees at Río Piedras, May 20, 1944. (GNW.)

Cryptocephalus nigrocinctus Suffrian

(Chrysomelidae) At Playa de Humacao, (IB:267), 1923.

Cryptocephalus perspicax Weise

(Chrysomelidae) Feeding on the foliage, at Quebradillas, (IB:268), 1922.

Coccobolus**Attelabus coccobolus** Wolcott

(Curculionidae) One of the most important pests of sea-grape. Found all around the coast, wherever the tree grows. (LFM.)

Exophthalmodes roseipes (Chevrolat)

(Curculionidae) On tender leaves, at Loíza (IB:293), 1922. Listed as *Prepodes roseipes* Chev.

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding on the foliage, on trees near the coast, at El Vigía, Arecibo, Oct. 23, 1940; very abundant. (LFM.)

Lachnopus curvipes (Fabricius)

(Curculionidae) At Loíza (IB:301-02), 1922.

DIPTERA**Cecidomyia coccobolus** (Cook)

(Itonididae) From small shaped galls on leaves of trees, (IB:333), 1917. Making small cone-shaped galls in leaves, on Mona Island, (SIB:112), 1939. (LFM.)

Ctenodactylomyia watsoni Felt

(Itonididae) From galls, on leaves, (IB:333).

LEPIDOPTERA**Eunebristis zingarella** (Walsingham)

(Gelechiidae) Reared by Mr. A. Busck, from tree at San Juan, Feb. 1899. Caterpillar a leaf-miner in leaves, forming round mines, listed (IB:489).

Acrocercops sp.

(Gracilariidae) Reared from serpentine mines in leaves of trees at Mameyes, (IB:499), 1936.

HYMENOPTERA**Sterictiphora krugii** (Cresson)

(Tenthredinidae) One of the worst insect pests of sea-grape trees. Very common, and recorded from many localities: Camuy, Guajataca, San Germán, Patillas, Maunabo, Bayamón, Joyuda, Fajardo and Salinas, (SIB:138), 1937-40.

Coccolobis

Neocatolaccus livii Girault

(Pteromalidae) Reared from galls, produced by *Ctenodactylomyia watsoni* Felt, listed (IB:524).

Eretmocerus portoricensis Dozier

(Aphelinidae) Reared from the coccid *Aleurothrixus floccosus* (Maskell) on sea grape tree, (IB:146).

Eurytoma ctenodactylomyii Girault

(Eurytomidae) From galls in sea-grape, caused by the dipterous *Ctenodactylomyia watsoni* Felt, (IB:534).

Insects Affecting the Branches and Twigs

ISOPTERA

Kalotermes (K) snyderi Light

(Kalotermitidae) Infesting the dead branches of trees, abundant. Mona Island, April 5, 1944. (GNW. & LFM.)

HOMOPTERA

(Fulgoridae)

Bothriocera venosa Fowler

At Añasco, listed (IB:94).

Neurotmeta viridis Walker

At Loíza (IB:97), 1922.

Thionia borinquensis Dozier

Nymphs abundant, and a few adults, on tree, at Loíza, (IB:98), 1922.

Colpoptera maculata Dozier

At Salinas and Cataño, (IB:99).

Colpoptera maculifrons Muir

At Punta de Cangrejos (IB:100).

Ormenis marginata (Brunnich)

At Añasco (IB:102); at Mona Island, (SIB:53), 1939. (LFM.)

Ormenis pygmaea (Fabricius)

At San Juan, Salinas, Añasco, Isabela, Hatillo, (IB:103). All stages abundant, on twigs, sometimes going under the leaves, at Mona Is., (SIB:53), 1939. (LFM.)

Coccobolus**Ormenis quadripunctata** (Fabricius)

At Isabela (IB:104), 1921.

Flatoides punctata (Walker)

At Isabela (IB:104), 1921. At Mona Island, listed (SIB:53), 1939. (LFM.)

(Coccidae)

Pulvinaria urbicola Cockerell

At Punta Cangrejos, listed (SIB:59), 1921.

Coccus viridis (Green)

On twigs and leaves, at Mona Island, (SIB:59), 1939.

COLEOPTERA**Cylindera flava** (Fabricius)

(Cerambycidae) Larvae boring in twigs. One adult collected. Mona Island, April 6, 1944. (GNW.)

HYMENOPTERA

(Formicidae)

Myrmelachista ramulorum Wheeler

In hollow twigs of trees, (IB:554).

Camponotus ustus Forel

In hollow twigs, listed (IB:555).

Insects Affecting the Trunk

ISOPTERA**Nasutitermes** (N.) **costalis** (Holmgren)

(Termitidae) Large tree with nest and tunnels at Guajataca, Nov. 17, 1940. At Maunabo, many trees with tunnels on the trunks, Oct. 20, 1940. Same at Salinas, Nov. 1940. (LFM.)

Kaloterms (K.) **snyderi** Light

(Kalotermitidae) Infesting trunk of trees at Mona Island, Jan. 1941. (LFM.)

Coccolobis

Coccolobis venosa L.

(Polygonaceae)

DISTRIBUTION: A tree, growing in thickets and on hillsides at lower and middle elevations, in dry or moist districts of Puerto Rico. Also recorded from Mona, Vieques, St. Croix, St. Thomas, Tortola, Jamaica, Hispaniola and from St. Barts to Trinidad.

COMMON NAMES: "Calambreña" and Chigerry grape.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Coccus viridis (Green)

Heavy infestation of leaves and twigs, particularly on the undersides of leaves, near the midrib, at Guánica, May 22, 1940. (LFM.)

Chrysomphalus (Melenaspis) portoricensis Lindinger

In tree, near Las Cruces, Cayey, listed (SIB:61).

HYMENOPTERA

Sterictiphora krugii (Cresson)

(Tenthredinidae) Larvae on foliage of trees, at Maunabo, June 1942. (LFM.)

Cocos

Cocos nucifera L.

(Areaceae)

DISTRIBUTION: A palm, locally spontaneous after cultivation in Puerto Rico, St. Croix, St. Thomas, St. Jan, Tortola and also found in all the tropical islands and coastal regions of the world. The palm is unknown anywhere in a wild state, but presumably is of American origin.

USES: Extensively planted and of great economic importance. The

Cocos

"milk" or "Agua de coco" of the green fruit is in great demand locally. The ripe fruit is exported in large quantities. The wood is used in walking sticks, umbrella handles, posts, piles, etc. The fiber of the husk, known as coir and the dried meat of the nut, known as copra, are important articles of export from the East Indies to Europe.

COMMON NAMES: "Palma de coco," "Coco," "Cocotero," Coconut palm, Coconut, Coco palm and Porcupine wood. (Br. W. I.)

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA****(Coccidae)**

Icerya montserratensis Riley & Howard

Listed, (IB:119).

Pseudococcus nipae (Maskell)

At Santurce, Arecibo and Sta. Isabel, (IB:126).

Ceroplastes denudatus Cockerell

At Puerta de Tierra, listed (SIB:59).

Ceroplastes floridensis Comstock

Listed (SIB:59).

Aonidiella orientalis (Newstead)

At Punta de Cangrejos (IB:137); also in (SIB:60).

Aspidiotus destructor Signoret

The most injurious pest of coconut palms in the island of Puerto Rico. At Ponce, many of the coconut palms were killed by the coccid (Barrett). Many locality records listed in (IB:137-8). Also recorded from Mona Is., (SIB:61). (LFM.)

Chrysomphalum aonidum (Linnaeus)

Listed (IB:139).

Chrysomphalus dictyospermi (Morgan)

Listed, (IB:140), 1914.

Chrysomphalus personatus (Comstock)

At Punta de Cangrejos (IB:140), 1921.

Cocos

Ischnaspis longirostris (Signoret)

At Caguas, Cataño, Mayagüez and Arroyo, recorded by Mr. A. Busck, Jan. and Feb., 1899. At Mayagüez, but on the outside of the husk, listed (IB:142-43).

(Aleyrodidae)

Aleurodicus cocois (Curtis)

Adults and pupae abundant on the undersides of coconut palms foliage at Río Piedras, Dec. 11, 1924. Also at Guayama, 1930, (IB:144). (Dozier.)

COLEOPTERA

(Coccinellidae)

Decadiomus pictus Chapin

Feeding on coconut scales, listed (SIB:92).

Psorolyma maxillosa Sicard

Listed in (IB:230). Possibly feeding on coconut scales.

Scymnillus nunenmacheri Sicard

Feeding on *Aspidiotus destructor* Signoret, on palms, listed (IB:230), 1921.

Scymnillus variipennis Sicard

Feeding on *Aspidiotus destructor* Signoret, on palms, at Ponce (IB:230), 1913.

Scymnillodes cyanescens violaceus Sicard

Feeding on the coconut scale, *Aspidiotus destructor* Signoret, (IB:230), 1921.

Chilocorus cacti (Linnaeus)

Feeding on coconut scales, both larvae and adults very abundant, on palm fronds, at Río Piedras, March 2, 1940. Pupae also attached to the undersides of leaves. (LFM.)

LEPIDOPTERA

Homaledra sabalella (Chambers)

(Cosmopterygidae) Caterpillars common on the leaves of palms, at Punta de Cangrejos, Manatí, Mayagüez, Naguabo and Vieques Is., listed (IB:486).

Cocos

HYMENOPTERA

Aphytis chrysomphali (Mercet)

(Aphelinidae) An important parasite, responsible for the control of the coconut scale, *Aspidiotus destructor* Signoret, (IB:526). Listed as *Aphelinus chrysomphali* Mercet.

Brachymeria incerta (Cresson)

(Chalcididae) From *Homaledra sabalella* (Chambers), the coconut leaf caterpillar, listed (IB:535), 1923.

Spilochalcis homaledrae Wolcott

(Chalcididae) From coconut palm fronds, infested with *Homaledra sabalella* (Chambers), in (IB:536), 1923.

Spilochalcis cocois Wolcott

From coconut palm fronds, infested with *Homaledra sabalella* (Chambers), in (IB:537), 1923.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest in palm (IB:49), 1915. Nest and tunnels on the trunk of a very high palm, at Lares, altitude 1,270 ft., Dec. 10, 1941. At Guajataca, Maunabo, Yabucoa, Luquillo beaches, many palms infested, 1941. (LFM.)

LEPIDOPTERA

Megalopyge krugii (Dewitz)

(Megalopygidae) Cocoons on the trunk of palms, very abundant, Sept. 14, 1940, at Ponce. Whether the caterpillars were feeding on the foliage of the palm or they came to pupate there, from adjoining host trees, is not known. (LFM.)

COLEOPTERA

Strataegus quadriveatus Palisot de Beauvois

(Scarabaeidae) One of the worst pests of coconut palms in the Island. Attacking the trunk and roots of palms. Very common on coconut groves. Extended account on (IB:254-255).

Cocos

Xyleborus affinis Eichhoff

(Scolytidae) From dying coconut palms (IB:318), 1935.

Xyleborus confusus Eichhoff

From coconut palm at Cabo Rojo (IB:318), 1923.

Colubrina

Colubrina arborescens (Mill.) Sarg.

(Rhamnaceae)

DISTRIBUTION: A shrub or tree, growing in woodlands, thickets and on hillsides at lower and middle elevations, in dry and moist districts of Puerto Rico. Also recorded from Mona, Icacos, Vieques, Culebra, St. Croix, St. Jan, St. Thomas, Tortola, Virgin Gorda, Anegada, Florida, Cuba, Jamaica, Hispaniola, Antigua and Barbados. (In Britton and Wilson, Vol. 5, p. 536 as: *Colubrina Colubrina* (Jacq.) Millsp.)

USES: The yellowish brown wood is hard, strong and durable and is sometimes used in construction.

COMMON NAMES: "Abejuelo," "Abeyuelo," "Aguacatillo," "Mabí," "Achiotillo," "Ratón," "Aguaytarán," "Guitarán," "Sanguinaria," Snake wood, Snake bark, West Indian green heart, Iron wood and Soap tree.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Apodrosus argentatus Wolcott

(Curculionidae) Mr. E. G. Smyth, records this species as, "Feeding on leaves of tree, at Guánica," (IB:303), 1914. Also collected at Mayaguez. Abundant on young shoots, at Mona Is., probably feeding on the tender foliage. (LFM.) 1940.

LEPIDOPTERA

Spilomela fimbriauralis (Guenée)

(Pyraustidae) Caterpillar of this species a leaf-roller on tree; many adults reared from material collected at Guajataca and San Sebastián,

Colubrina

Oct., Nov. and Dec. 1940. Ranging in altitudes from 15 to 450 ft. (LFM.)

Insects Affecting the Trunk and Branches**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Large trees with nests and tunnels on the trunk, Km. 22 of the Camuy-San Sebastián road, at Guajataca, Oct. 19, 1941. (LFM.)

HOMOPTERA**Pinna sp. minor** (Maskell)

(Coccidae) On tree, at Quebradillas (SIB:60), 1940. On the Camuy-San Sebastián road, Km. 22, many trees, with the trunks and branches infested by the scale insect. The lady-bird beetle, *Chilocorus cacti* (Linnaeus) abundant, feeding on the scales. Altitude 900 ft., Oct. 19, 1941. (LFM.)

COLEOPTERA**Chilocorus cacti** (Linnaeus)

(Coccinellidae) Larvae and adults abundant, feeding on the scale insect, *Pinnaspis minor* (Maskell) infesting trees at San Sebastián, altitude 900 ft., Oct. 19, 1941. (LFM.)

HYMENOPTERA**Camponotus ustus** Forel

(Formicidae) In hollow twigs, nesting and breeding abundantly. Camuy-San Sebastián road, Km. 22, altitude 900 ft., Oct. 19, 1941. (LFM.)

Insects Resting on the Tree**HEMIPTERA****Diolcus irroratus** (Fabricius)

(Scutelleridae) At Mayagüez, listed (IB:182).

COLEOPTERA

(Chrysomelidae)

Nodonota wolcottii Bryant

At Mayaguez, (IB:269).

Colubrina

Asbecesta violacea Allard

? on tree, at Guánica (IB :270).

Disonycha laevigata Jacoby

At Mayagüez, (IB :277).

Aphthona compressa Suffrian

At Mayaguez, (IB :284).

Conocarpus

Conocarpus erectus L.

(Terminaliaceae)

DISTRIBUTION: A shrub or tree, growing on coastal rocks and in mangrove swamps in Puerto Rico. Also recorded from Mona, Icacos, Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Anegada, Florida, Bermuda, Cuba, Jamaica, Hispaniola, continental tropical America and western tropical Africa. (In Britton & Wilson, Vol. 6, p. 23 as: *Conocarpus erecta* L.)

USES: The brownish, hard, strong and very heavy wood is used for building boats, barges and for shelving. It is also turned into charcoal to be used in forges. The wood is very durable when the trees grow on dry soil.

COMMON NAMES: "Mangle," "Mangle botón," "Mangle botoncillo," "Botoncillo," "Mangle colorado," Button wood and Button tree.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Nodonota wolcottii Bryant

(Chrysomelidae) Abundant on host tree, at Faro de Cabo Rojo, (IB :269), 1921. Presumably feeding on the foliage.

Exophthalmodes roseipes (Chevrolat)

(Curculionidae) On beach west of Arecibo, (IB :293), 1923. Listed as *Prepodes roseipes* Chevr.

Conocarpus**Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) At Boca de Cangrejos, (SIB:103), 1940. Leaves of terminal shoots badly eaten, at Luquillo, May 15, 1943. (GNW.)

Lachnopus curvipes (Fabricius)

(Curculionidae) At Punta Salinas (IB:302), 1923.

LEPIDOPTERA**Jocara** sp.

(Epipaschidae) A leaf-webber on trees, causing total defoliation, at El Pastillo, between Ponce and Sta. Isabel. Many pupae parasitized by the chalcid wasp, *Brachymeria incerta* (Cresson), Jan. 5, 1941. (LFM.) Leaf-webber also observed on tender leaves of trees at Mona Island, April 5, 1944. (GNW. & LFM.)

Megalopyge krugii (Dewitz)

(Megalopygidae) On trees at Martín Peña, (IB:505), 1923.

HYMENOPTERA**Brachymeria incerta** (Cresson)

(Chalcididae) Reared from pupae of *Jocara* sp., the leaf-webber on "botoncillo," collected between Ponce-Sta. Isabel, at El Pastillo, Jan. 5, 1941. (LFM.)

Insects Affecting the Trunk and Branches**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nests and tunnels on many trees at Camp Piñones, Boca de Cangrejos, Sept. 15, 1940. Also trees infested at El Pastillo, near Santa Isabel, Nov. 1941. (LFM.)

Kalotermes (K.) snyderi Light

(Kalotermitidae) Infesting the dead branches of live trees, abundant. Mona Island, April 5, 1944. (GNW. & LFM.)

HOMOPTERA**Asterolecanium pustulans** (Cockerell)

(Coccidae) Listed in (IB:22), 1917. Also in (SIB:57), 1940. Tremendous infestation of young trees at El Pastillo, near Santa Isabel,

Conocarpus

killing many trees. Trunks and branches fully covered by the scale insects, some of the trees were just a mass of brown, dried branches and leaves. Oct. 15, 1940. (LFM.)

Cordia

Cordia alliodora (R. & P.) Cham.

(Ehretiaceae)

DISTRIBUTION: A tree, growing in forests, river valleys and on hillsides, at lower and middle elevations, ascending to about 900 meters in Puerto Rico. Recorded also from Vieques, St. Thomas, St. Jan, Tortola, Cuba, Hispaniola, from Antigua to Trinidad and continental tropical America. (In Britton & Wilson, Vol. 6, p. 123 as: *Cerdana alliodora* R. & P.)

USES: The light, but strong and durable brown wood, is used for furniture and general construction, such as doors, venetian blinds, gun carriages cots, bungs of barrels and rollers in sugar mills.

COMMON NAMES: "Capá prieto," "Capá," Capaw, Spanish elm and Prince wood.

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA*****Protalebra cordiae* Osborn**

(Cicadellidae) Nymphs and adults causing yellowing of leaves, on trees attacked at San Lorenzo, on the Patillas road. Altitude 300 ft., Aug. 25, 1940. At Cayey, near El Peñón del Collao, on the Salinas road, altitude 1,900 ft., a large tree with foliage attacked by the leafhopper nymphs and adults, was nearly yellow on account of the tremendous infestation, Oct. 19, 1940. (LFM.)

HEMIPTERA***Monanthia monotropidia* Stål**

(Tingitidae) A very important pest of this tree, causing considerable defoliation. All stages abundant on the undersides of leaves, at

Cordia

Cayey, 1,500 ft. altitude (SIB:71), 1940. At San Lorenzo, trees attacked, with leaves already showing the characteristic chlorosis, altitude 300 ft., Aug. 25, 1940. At Aguadilla, near Punta Borinquen, trees all around the vicinity infested by this insect, many of them partially defoliated, Oct. 4, 1940. (LFM.)

COLEOPTERA**Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) Adults feeding on the foliage, abundant, at Quebradillas, May 22, 1941. (LFM.)

LEPIDOPTERA**Conchylodes diphteralis** (Geyer)

(Pyraustidae) A leaf-webber, caterpillars gregarious in habits. At El Peñón del Collao, Cayey, 1,800 ft., in altitude, Oct. 10, 1940. Not a common species. (LFM.)

Acrocercops sp.

(Gracilariidae) A leaf-miner causing severe damage in very young trees, along roadsides, near El Peñón del Collao, Cayey, 1,900 ft. altitude, Oct. 20, 1940. (LFM.)

Insects Affecting the Branches and Twigs**HOMOPTERA****Flatoides punctata** (Walker)

(Fulgoridae) Collected on twig of tree, at San Lorenzo, altitude 300 ft., Aug. 25, 1940. (LFM.)

Saissetia oleae (Bernard)

(Coccidae) Considerable infestation on twigs and smaller branches of several trees, near Salinas, on the Cayey road, altitude 250 ft., (SIB:59), 1940. (LFM.)

HYMENOPTERA**Solenopsis geminata** (Fabricius)

(Formicidae) Abundant on the twigs and branches, attending the scale insect *Saissetia oleae* (Bernard), on trees at Salinas, (SIB:149), 1940. (LFM.)

Cordia

Cordia borinquensis Urban

(Ehretiaceae)

DISTRIBUTION: A tree, growing in woods, forests and ravines, in wet or moist districts, at middle or higher elevations in Puerto Rico. Endemic.

USES: Its yellowish wood is rather hard and heavy; however it is not used locally.

COMMON NAMES: "Muñeca," "Palo de muñeca" and "Capá cimarrón."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Cryptocephalus nigrocinctus Suffrian

(Chrysomelidae) At Camuy, listed (IB:267), 1924. Possibly feeding on the foliage.

Cordia nitida Vahl

(Ehretiaceae)

DISTRIBUTION: A tree, growing in woodlands, forests, on hillsides and along streams, at lower and middle elevations, in dry and moist districts of Puerto Rico. Also at Vieques, St. Thomas, St. Jan, St. Croix, Tortola, Jamaica, Cuba and Hispaniola.

COMMON NAMES: "Cerezo," "Cereza," "Cereza cimarrona," "Muñeca," West Indian cherry and Red manjack.

INSECT RECORDS

Insects Affecting the Leaves

HEMIPTERA

Pachycoris fabricii (Linnaeus)

(Scutelleridae) Adults and eggs on leaves of trees, at Maricao Insular Forest 1,900 ft. in altitude, (SIB:80), 1940. Also on same host tree, near Peñón del Collao, eggs, nymphs and adults, breeding on the foliage, Dec. 24, 1940, altitude 2,000 ft. (LFM.)

Cordia

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Tunnels and nests on host trees, at Islote, Arecibo, Dec. 1, 1940. (LFM.)

Cordia sulcata DC.

(Ehretiaceae)

DISTRIBUTION: A tree, growing in woodlands and forests in wet and moist districts, at lower and middle elevations in Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Hispaniola and from Saba to Trinidad.

USES: Wood little used locally; in Jamaica however, it is claimed to be a good timber.

COMMON NAMES: "Moral," "Moral de paz" and White manjack.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA**Protalebra aureovittatus** DeLong

(Cicadellidae) At El Verde, Río Grande, (SIB:52), 1940. Also nymphs and adults very abundant, on the undersides of leaves, at Barrio Guayabota, Yabucoa, 1,300 ft. altitude, Aug. 25, 1940. Also at Aguas Buenas, 1,000 ft., but not so abundant, June 2, 1940. (LFM.)

HEMIPTERA**Paracarnus cubanus** Bruner

(Miridae) Quite common, on the undersides of leaves, at El Verde, Río Grande and at Cayey, altitude 1,300 ft., (SIB:66), 1940. (LFM.)

COLEOPTERA**Galerucella varicornis** Weise

(Chrysomelidae) Feeding on the leaves of tree, making numerous holes, at Mayagüez, (IB:270), 1923.

Cordia

LEPIDOPTERA

Oiketicus kirbyi Guilding

(Psychidae) At Cayey, on foliage, (SIB:137), 1940. (LFM.)

Megalopyge krugii (Dewitz)

(Megalopygidae) Caterpillar on foliage at Cayey, Nov. 1940. (LFM.)

HYMENOPTERA

Crematogaster steinheili Forel

(Formicidae) Sheds built over coccids on leaves, by ants, at Culebra Is., (IB:546).

Insects Affecting the Twigs

HOMOPTERA

Saissetia oleae (Bernard)

(Coccidae) Branches of large tree and twigs infested by the insect, at Aibonito, altitude 1,800 ft., Oct. 13, 1940.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest on tree at Cayey, about 1,500 ft., in altitude (SIB:43), 1940. Nest on one tree and tunnels on many at Aguas Buenas, June 2, 1940. Also at Río Abajo, Utuado, 1,200 ft. altitude, April 4, 1941. (LFM.)

Crescentia

Crescentia cujete L.

(Bignoniaceae)

DISTRIBUTION: A tree, growing on hillsides and plains at lower elevations in Puerto Rico. Also recorded from Desecheo, St. Thomas, St. Croix, St. Jan, Tortola, Florida, Cuba, Jamaica, Hispaniola and continental tropical America.

USES: The wood is light brown, tough and durable, with a specific gravity of about 0.8. It is not known to be of any use locally, but the

Crescentia

rind or bony outside of the fruit, like the shell of the coconut, finds a multiplicity of domestic uses, as for cooking utensils, drinking cups, tableware, etc. In Jamaica, the wood is used for tool handles, carriage parts, felloes of wheels, saddles and chairs. It is also employed for ship knees and cabinet work in Mexico and Central America.

COMMON NAMES: "Higüero," "Higüera," Calabash and Calabash tree.

INSECT RECORDS**Insects Affecting the Leaves****LEPIDOPTERA****Eulepte concordalis** Hübner

(Pyraustidae) Larvae on leaves of tree at Ciales (IB:459), 1912 and 1916. Larvae on leaves at Ponce (SIB:130), 1940. (Listed in both, as *Mesocondyla concordalis* Hübner). The caterpillar of this species is a leaf-webber, and attacks the trees, the whole year in all parts of the Island. (LFM.)

Insects Affecting the Twigs**HOMOPTERA****Saissetia oleae** (Bernard)

(Coccidae) Collected by Mr. A. Busck, at Lares, January 25, 1899, in (IB:133).

Insects Affecting the Trunk**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Large tree attacked by termites, at Aguadilla, Dec. 19, 1940. (LFM.)

Cupania*Cupania americana* L.

(Sapindaceae)

DISTRIBUTION: A tree, growing in wooded hills, on river banks and

Cupania

along creeks, at lower and middle elevations in Puerto Rico. Also recorded from Cuba, Hispaniola, Martinique, Trinidad and Venezuela.

USES: The light brown, soft wood, is largely used for posts.

COMMON NAMES: "Guara" and "Guara blanca."

INSECT RECORDS

LEPIDOPTERA

Nyridela chalciope (Hübner)

(Amatidae) According to Möschler, p. 113, the caterpillar of this species, lives on this tree, (IB:412).

Ophisma tropicalis Guenée

(Phalaenidae) According to Möschler, p. 201, the caterpillar of this species, lives on this tree, (IB:430).

Hippia insularis (Grote)

(Notodontidae) According to Moschler, p. 123, the caterpillar of this species, lives on this tree. (IB:444). Listed as *Edema insularis* Grote.

Oiketicus kirbyi Guilding

(Psychidae) Dr. Möschler, p. 122, says that the caterpillar of this species lives on *Cupania*, not specifying which species, (IB:502).

Insects Affecting the Twigs

HOMOPTERA

(Coccidae)

Asterolecanium pustulans (Cockerell)

Many terminal branches and twigs killed by an intensive attack of this scale insect, on several trees, at Manatí, Sept. 27, 1940. (det: Morrison) (LFM.).

Howardia biclavis (Comstock)

On twigs of trees, at Manatí, Sept. 27, 1940. (det: Morrison) (LFM.).

Aulacaspis (Pseudalacaspis) major (Cockerell)

On twigs of trees, at Manatí, Sept. 27, 1940. (det: Morrison) (LFM.).

Cyrilla*Cyrilla racemiflora* L.

(Cyrillaceae)

DISTRIBUTION: A very large tree, growing in thickets and mountain forests in wet or moist districts of Puerto Rico. Also recorded from Cuba, Jamaica, Hispaniola, southeastern United States, Guadeloupe to St. Vincent and northern South America.

COMMON NAMES: "Colorado," "Colorao," "Palo colorado," and Southern leatherwood.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Kaloterms (Glyptoterms) pubescens Snyder

(Kalotermitidae) Termites on wooden logs of trees, very recently cut, about a week ago. Very heavy infestation, which with all the probabilities started while the tree was living. El Yunque Mts., altitude 1,800 ft., Sept. 29, 1940. (LFM.)

Dacryodes*Dacryodes excelsa* Vahl

(Burseraceae)

DISTRIBUTION: A large tree, growing in the forests of Puerto Rico at high altitudes. The most majestic tree in our Island. Also recorded from Montserrat to Grenada.

USES: The brown wood is hard, heavy and strong, used for furniture, in carpentry and general construction. The trunk and roots exude a

COMMON NAMES: "Tabonuco" and Candle tree.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest on tree, at Matrullas, mountains northeast of

Dacryodes

Villalba, (SIB:43), 1939. Nests and tunnels on trees at El Yunque Mts., Luquillo Unit, altitude 1,200 ft., June and Sept. 1940. (LFM.)

COLEOPTERA

(Platypodidae)

Platypus rugulosus Chapuis

Adults collected in "tabonuco" logs, boring inside, at El Guineo Camp, Toro Negro Unit, May 1940. (det: Blackman) (D. DeLeón & LFM.).

Platypus compositus Say

A single adult taken from a log, at El Guineo Camp, Toro Negro Unit, May 1940. (det: Blackman) (D. DeLeón & LFM.).

(Scolytidae)

Pterocyclon bivittatum Blandford

Taken from logs on the ground, at El Guineo Camp, Toro Negro Unit, May 1940. (det: Blackman, as sp. near *bivittatum*) (D. DeLeón & LFM.).

Ambrosiodmus lecontei Hopkins

Adults common, boring in trunks or logs of trees, on the ground, at El Guineo Camp, Toro Negro Unit, May 1940. (det: Blackman) (D. DeLeón & LFM.).

Dalbergia

Dalbergia ecastophyllum (L.) Taub.

(Fabaceae)

DISTRIBUTION: A tree-like plant, growing in coastal thickets, mangrove swamps and along streams at lower elevations in Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Florida, Bahamas, Jamaica, Cuba, Trinidad, continental tropical America and tropical Asia. (In Britton & Wilson, Vol. 5, p. 406 as: *Ecastophyllum Ecastophyllum* (L.) Britton.)

COMMON NAMES: "Maraimaray" and "Palo de pollo."

Dalbergia

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Cryptocephalus nigrocinctus Suffrian

(Chrysomelidae) At Humacao and Algarrobo, (IB:267), 1922-23.

Cryptocephalus perspicax Weise

Abundant, feeding on the leaves, at Punta Salinas, in (IB:268), 1923.

Exophthalmodes roseipes (Chevrolat)

(Curculionidae) At Mayaguez, in (IB:293). Listed as *Prepodes roseipes* Chevrolat.

Lachnopus curvipes (Fabricius)

(Curculionidae) At Algarrobo, 1922 and at Palo Seco, April 7, 1931, (IB:302).

Apodrosus argentatus Wolcott

(Curculionidae) Abundant on trees, at Boquerón (IB:203), 1923; also at Punta de Cangrejos, Punta Salinas and Mameyes.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Trees near Maunabo, at Cabo de Mala Pascua, altitude 150 ft., infested by "comején." Oct. 20, 1940. (LFM.)

Dalbergia sissoo Roxb.

(Fabaceae)

DISTRIBUTION: A tree, native to Asia, planted at the Agricultural Experiment Station and at the U. S. Forest Service grounds, at Río Piedras.

COMMON NAME: "Siso."

Dalbergia

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest and tunnels on trunk of a fairly large tree, growing at the Polytechnic Institute grounds, San Germán, Oct. 24, 1940.

Daphnopsis

Daphnopsis caribaea Griseb.

(Thymelaeaceae)

DISTRIBUTION: A shrub, or tree, growing in thickets, woodlands and on river banks, at lower and middle elevations in wet or moist districts, in Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, from St. Martin to Trinidad, Tobago and Margarita.

COMMON NAMES: "Majagua de sierra" and Mahout.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Aleuroplatus vinsonioides (Cockerell)

(Aleyrodidae) on *Daphnopsis* sp., at Mt. Britton Trail, El Yunque Mts., May 8, 1941. (GNW.) Pupal stage of these specimens covered by a whitish wax. Same species, but with a yellow waxy covering collected on other tree species.

Insects on the Twigs and Leaves

Pachycoris fabricii (Linnaeus)

(Scutelleridae) Adults and nymphs very abundant on twigs, of tree, at Barrio Guavate, Cayey, altitude 1,500 ft., Aug. 15, 1940. (LFM.)

Delonix

Delonix regia (Bojer) Raf.

(Caesalpiniaceae)

DISTRIBUTION: A tree, native to Madagascar, but after introduced, now grows spontaneously. In roadsides and gardens in Puerto Rico, at lower and middle elevations. Also recorded from St. Croix and St. Thomas.

USES: The wood is whitish or yellowish, close-grained, weak, soft and light. It is used very little locally, except as firewood. The dry pods are also used for the same purpose. The tree itself is planted as an ornamental and shade tree.

COMMON NAMES: "Flamboyán," "Flamboyán colorado," Royal Poinciana and Flame tree.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding on foliage, at Rio Blanco, Naguabo, altitude 250 ft., May 27, 1941.

LEPIDOPTERA

Melipotis acontioides (Guenée)

(Phalaenidae) Caterpillars on tree, at Manati; also a serious outbreak defoliating many trees between El Condado and Hato Rey, August 1933, (IB:436), (F. Scin). Larvae defoliating trees at Guánica, Ensenada and the vicinity around for many miles, (SIB:127), 1937. Also at Isabela, Dec. 11, 1941. (GNW. & LFM.)

Semiothisa sp.

(Geometridae) Larvae defoliating trees at Guánica, very abundant, listed in (IB:451), 1916.

Pococera atramentalis Lederer

(Epipaschidae) Reared from buds, in (SIB:132).

Megalopyge krugii (Dewitz)

(Megalopygidae) Thousands of cocoons attached to the trunk of trees and several caterpillars on twigs. Many trees defoliated, at Ponce, Sept. 19, 1940. (LFM.)

Delonix

Insects Affecting the Branches

Stephanoderes sp. near **braziliensis** Hopkins

(Scolytidae): Reared from branches, of tree at the School of Tropical Medicine, San Juan; W. A. Hoffman, Collector, March 1942.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) **costalis** (Holmgren)

(Termitidae) One of the most common host trees, of this species of insect, in the island. At low and middle altitudes, up to 2,000 ft. Nearly every tree in Puerto Rico is infested. (LFM.)

HOMOPTERA

Asterolecanium pustulans (Cockerell)

(Coccidae) Rare on this tree, (IB:122). (GNW.)

COLEOPTERA

Apate monachus Fabricius

(Bostrychidae) Larvae boring in tree, (IB:243-44). Adult females boring in trees, at Guayanilla, (SIB:94), 1937. (LFM.)

Didymopanax

Didymopanax morototoni (Aubl.) Dcne. & Pl.

(Araliaceae)

DISTRIBUTION: A tree, growing in the mountain forests of Puerto Rico. Also recorded from St. Thomas, St. Jan, Cuba, Hispaniola, Guadeloupe, Trinidad and northern South America.

USES: The hard and heavy, nearly white wood is used for boards and beams in house building, and has been suggested as a good material for making matches.

COMMON NAMES: "Yagrumo macho," "Yagrume," "Grayume," "Grayume macho," "Grayumo" and "Pana cimarrona."

Didymopanax**INSECT RECORDS****Insects Affecting the Leaves****COLEOPTERA****Phyllophaga portoricensis** (Smyth)

(Scarabaeidae) Adults defoliating many large trees at Río Blanco, Naguabo, altitude 200 ft., on Sept. 28, 1940 and March 5, 1941. (LFM.)

LEPIDOPTERA**Sylepta silicalis** (Guenée)

(Pyraustidae) Larvae a leaf-roller, at Lares, (IB:461), 1922.

Sparagmia gigantis Guenée

(Pyraustidae) Caterpillar on trees, presumably feeding on the foliage, (IB:466), 1922.

Insects Affecting the Trunk**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Many trees infested at Guavate Camp, near Cayey, Aug. 11, 1940. One tree, at the Agricultural Experiment Station grounds, with tunnels on its trunk, June 1942. (LFM.)

Dillenia*Dillenia indica* L.

(Dilleniaceae)

DISTRIBUTION: A tree, introduced into Puerto Rico, and now growing at the Experiment Station grounds, at Mayagüez.

INSECT RECORDS**Insects Affecting the Leaves**

Dillenia

HOMOPTERA

Aspidiotus cyanophylli Signoret

(Coccidae) Recorded by Mr. Van Zwaluwenburg, listed in (IB:137).

Dipholis

Dipholis salicifolia (L.) A. DC.

(Sapotaceae)

DISTRIBUTION: A tree, growing in woodlands, on hillsides and along streams, at lower elevations in dry and moist districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Florida, Cuba, Jamaica, Hispaniola, Yucatán and Barbados.

USES: The red-brown wood is hard and strong, with a specific gravity of 0.93; used locally for fuel and charcoal.

COMMON NAMES: "Almendrón," "Sanguinaria" and Bustic.

INSECT RECORDS

Insects Attacking the Trunk

ISOPTERA

Kaloterms (K.) snyderi Light

(Kalotermitidae) Infesting tree, at Mona Is., (SIB:41), 1939. (LFM.)

COLEOPTERA

Xyleborus spinulosus Blandford

(Scolytidae) Collected from tree, at St. Johns, Virgin Is., May 29, 1940. (D. DeLeón.) (Note: This is not a Puerto Rico record.)

HYMENOPTERA

Euchrysia buscki Ashmead

(Cleonymidae) One specimen collected by D. DeLeón, April 1940, at St. Johns, Virgin Islands, on the bark of a dead branch, infested with cerambycid beetles and larvae of *Xyleborus* sp. near *spinulosus* Blandford. (Note: This is not a Puerto Rico record.)

Elaeodendrum

Elaeodendrum xylocarpum (Vent.) DC.

(Celastraceae)

DISTRIBUTION: A tree, growing in coastal woods and thickets in Puerto Rico. Also recorded from Muertos, Icacos, Vieques, Culebra, Culebrita St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda and Anegada.

COMMON NAMES: "Coscorrón," "Cocorrón," "Guayarote," "Guayavoto," Marble tree, Spoon tree or Nut muscat.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Ceroplastes floridensis Comstock

(Coccidae) Abundant on the undersides of leaves and also on twigs of trees, at Arecibo, on the Vigía-Islote road, altitude near sea-level, Dec. 1, 1940. (LFM.)

COLEOPTERA

Exophthalmodes roseipes (Chevrolat)

(Curculionidae) Adults feeding on the foliage, not very abundant at Arecibo, on the Vigía-Islote road, Dec. 1, 1940. (LFM.)

LEPIDOPTERA

Horama pretus (Cramer)

(Amatidae) Caterpillars on host tree, at Punta de Cangrejos, 1916 and at Boquerón, 1923, (IB:113). Webbing leaves together, on trees, near Arecibo, on the Vigía-Islote road, Oct. 23, 1940. (LFM.)

Hyponomeuta triangularis Möschler

(Hyponomeutidae) Caterpillars making nests between leaves at Boquerón, 1923 and at Punta Salinas, (IB:484). (GNW.)

Insects Affecting the Twigs

HOMOPTERA

Ceroplastes floridensis Comstock

(Coccidae) On twigs of tree, at Arecibo, Dec. 1, 1940. (LFM.)

Insects Affecting the Trunk

Elaeodendrum

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) On trees at Guajataca Gorge, near Quebradillas, on Nov. 1940, and at Vigía-Isote road, near Arecibo, Dec. 1, 1940. (LFM.)

Erythrina

Erythrina berteroana Urban

(Fabaceae)

DISTRIBUTION: A tree, growing along roadsides and in pastures, naturalized after its introduction into Puerto Rico. Also recorded from Cuba, Hispaniola and Colombia.

USES: The wood is light, soft and weak and of very little economic importance. The tree is used for shade and also as live fences.

COMMON NAME: "Machete."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding on the leaves, causing heavy defoliation, at El Vigía-Isote road, near Arecibo, Sept. 27, 1940. (LFM.)

Insects Affecting the Twigs

HOMOPTERA

(Coccidae)

Saissetia oleae (Bernard)

On trees, at El Vigía-Isote road, near Arecibo, Sept. 27, 1940. (LFM.)

Pinnaspis sp.

Present on same twigs, with *Saissetia oleae* (Bernard), collected at Arecibo, Sept. 27, 1940. (det: Morrison) (LFM.).

Erythrina**Aonidiella orientalis** (Newstead)

Also on the twigs in combination with the two scale insects named before, at Arecibo, Sept. 27, 1940. (det: Morrison) (LFM.).

LEPIDOPTERA

(Pyraustidae)

Agathodes designalis Guenée

As a leaf-folder on trees, at El Vigía-Isote road, near Arecibo, Sept. 27, 1940. Not boring in the twigs. (LFM.).

Terastia meticulosalis Guenée

Caterpillars boring in twigs of trees, at Mayagüez, in (SIB:131).

HYMENOPTERA**Myrmelachista ramulorum** Wheeler

(Formicidae) Ants breeding in hollow twigs, on trees near Arecibo, Oct. 20, 1940. (LFM.)

Erythrina glauca Willd.

(Fabaceae)

DISTRIBUTION: A tree, growing on river banks and along roadsides, in the northern districts of Puerto Rico, probably an introduced species. Also recorded from St. Thomas, Cuba, Guadeloupe, Martinique, St. Vincent, Tobago, Central America and Venezuela.

USES: The wood is soft, light and weak, and has no use locally. In Venezuela the tree is used for shade in coffee and cacao plantations.

COMMON NAMES: "Bucare," "Búcar," "Bucayo" and "Gallito."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Membracidae)

Monobelus fasciatus (Fabricius)

Listed in (IB:74), 1913 and 1916. Presumably on the twigs of trees.

Erythrina

(Fulgoridae)

Neurotmata angustata Uhler

Listed in (IB:97), 1921.

Ormenis quadripunctata (Fabricius)

Breeding on the undersides of the leaves, nymphs and adults very abundant, apparently not doing any noticeable damage to the foliage, on the Río Piedras-Aguas Buenas road, altitude 400 ft., Dec. 15, 1940. (LFM.)

(Coccidae)

Icerya purchasii (Maskell)

Slight infestation on the undersides of leaves, on tree, at the Río Piedras-Aguas Buenas road, altitude 400 ft., Dec. 15, 1940. (LFM.)

Pseudococcus nipae (Maskell)

Listed (IB:127), 1918. Fairly abundant on trees, at Río Piedras and Aguas Buenas, especially on the undersides of the leaves, near the midrib, 1941. (LFM.)

Pseudococcus adonidum (Linnaeus)

Heavy infestation, on the undersides of leaves and on young twigs on trees at the Río Piedras-Aguas Buenas road, altitude 400 ft., Dec. 15, 1940. (LFM.)

Saissetia oleae (Bernard)

Listed (IB:133), 1913. Slight infestation on twigs and smaller branches on trees, at the Río Piedras-Aguas Buenas road, altitude 400 ft., Dec. 15, 1940.

Pseudaulacaspis pentagona (Targioni)

Infestation on twigs of a tree, at Camp Doña Juana, mountains north of Villalba, altitude 1,900 ft., 1940, listed (SIB:60). (LFM.)

(Aleyrodidae)

Aleurodicus antillensis Dozier

Three pupal cases on leaf, at Río Piedras, Dec. 22, 1934, listed (IB:145). (Dozier.)

DIPTERA

Baccha parvicornis Loew

(Syrphidae) From leaves infested with the mealybug, *Pseudococcus nipae* (Maskell). The larva of this fly is a predator on coccids, listed (IB:348), 1923.

Erythrina**LEPIDOPTERA****Agathodes designalis** Guenée

(Pyraustidae) Caterpillar of this moth, is a leaf-roller and twig borer on *Erythrina*. Sometimes fully grown caterpillars bore into the bark of trees to pupate (IB:463). At Cayey, near El Peñón del Collao, altitude 1,700 ft., (SIB:131), 1940. A very important pest of *Erythrina*. (LFM.)

Terastia meticulosalis Guenée

(Pyraustidae) Caterpillar twig and pod borer. Larva bored 90% of trees, in an experimental planting at the Río Piedras Agr. Exp. Station, (IB:464), 1921. Abundant, boring in twigs of trees, at Camp Doña Juana, altitude 1,900 ft., May 1, 1940. (LFM.) Adults reared from infested pods at Río Piedras.

Megalopyge krugii (Dewitz)

(Megalopygidae) Cocoons very abundant, attached to the trunks of trees, at Cayey, (IB:505). The caterpillar presumably feeding on the foliage.

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nests and tunnels on large tree, at Dorado, altitude 150 ft., Dec. 1, 1940.

COLEOPTERA**Xyleborus confusus** Eichhoff

(Scolytidae) Abundant under bark of dead tree, at Cayey (IB:318), 1917.

Erythrina poeppigiana (Walp.) O. F. Cook

(Fabaceae)

DISTRIBUTION: A tree, widely planted for coffee shade and along roadsides, in Puerto Rico. Recorded also from Jamaica, Cuba, Guadeloupe, Martinique and Trinidad. A native of Perú.

Erythrina

USES: The soft and perishable wood, is not locally used.

COMMON NAMES: "Bucare," "Palo de boyo," "Bucayo" and "Bois immortelle."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) At Palo Seco, April 7, 1931 and at Toa Baja, 1916, (IB:298).

LEPIDOPTERA

Ecpantheria icasia (Cramer)

(Arctiidae) Caterpillar feeding on foliage, according to Mr. Van Zwaluwenburg, (IB:416).

Agathodes designalis (Guenée)

(Pyraustidae) Caterpillar folding leaves on trees and feeding voraciously, at Aibonito, Oct. 13, 1940. (LFM.)

Insects Affecting the Twigs

HOMOPTERA

(Coccidae)

Saissetia oleae (Bernard)

At Mayagüez, listed (IB:133).

Pseudaulacaspis pentagona (Targioni)

At Mayagüez, listed (IB:135), as *Aulacaspis pentagona* Targioni.

Insects Affecting the Trunk

HYMENOPTERA

Myrmelachista ramulorum (Wheeler)

(Formicidae) Breeding in crevices in the bark of large tree. Eggs very abundant, Oct. 13, 1940, at Aibonito. (LFM.)

Eucalyptus*Eucalyptus citriodora* Hook

(Myrtaceae)

DISTRIBUTION: A tree, native to Australia, introduced into Puerto Rico and the Virgin Islands.

USES: Grown experimentally for forest and firewood purposes and also as a roadside tree.

COMMON NAMES: "Eucalipto oloroso," "Eucalipto de limón" and "Eucalipto."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA***Attelabus sexmaculatus* Chevrolat**

(Curculionidae) Rolling the leaves, of small seedlings, in nurseries at Cayey, altitude 1,000 ft., and also at Camp Patillas, altitude 400 ft., (SIB:102), 1940. (LFM.)

Eucalyptus robusta Smith

(Myrtaceae)

DISTRIBUTION: A tree, native to Australia, introduced into Puerto Rico and the Virgin Islands, occasionally planted in gardens and farms in Puerto Rico.

USES: Grown experimentally for forest and firewood purposes and as a roadside tree.

COMMON NAMES: "Eucalipto de pantano" and "Eucalipto."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA***Attelabus sexmaculatus* Chevrolat**

(Curculionidae) At Guavate Camp, many trees attacked by the weevil, doing considerable damage to the leaves; also at Camp Pati-

Eucalyptus

llas, adults very abundant, many small trees affected, May and August, 1940. (LFM.)

LEPIDOPTERA

Laphygma frugiperda (Abbot & Smith)

(Phalaenidae) Caterpillars attacking small seedlings, at the Río Piedras Forest Service nurseries, Nov. 15, 1940. (det: Wolcott.) (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels and nests on trees, at the Polytechnic Institute grounds, at San Germán, Oct. 24, 1940. (LFM.)

Eugenia

Eugenia biflora lancea (Poir.) Krug & Urban

(Myrtaceae)

DISTRIBUTION: A shrub or a small tree, growing in thickets at lower elevations, mostly in moist districts of Puerto Rico. Also recorded from Cuba, Vieques, St. Croix, St. Thomas, Tortola, Virgin Gorda, Hispaniola and St. Martin. (In Britton & Wilson, Vol. 6, p. 35, as: *Eugenia lancea* Poir.)

COMMON NAMES: "Hoja menuda," "Pitangueira" and Black rod-wood.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Aleyrodidae)

Aleurodicus griseus Dozier

On leaves and twigs at Punta de Cangrejos, (IB:144), 1915. Also at Palo Seco, (SIB:62), 1939. (In all the records the host tree is listed as *Eugenia ludibunda* Bert. = *biflora lancea* (Poir.) Krug & Urban.)

Eugenia*Eugenia jambos* L.

(Myrtaceae)

DISTRIBUTION: A tree, growing in thickets and woodlands, at lower and middle elevations, abundant, especially along streams, in Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Tortola, Cuba, Jamaica, Hispaniola and continental tropical America. A species native to Asia. (In Britton & Wilson, Vol. VI, p. 41 as: *Jambos Jambos* (L.) Millsp.)

USES: The wood is used for barrel hoops, fuel and charcoal. It also furnishes material from which large baskets are made.

COMMON NAMES: "Pomarrosa," Rose apple and Malabar plum.

INSECT RECORDS

Insects Affecting the Fruits

DIPTERA**Anastrepha mombinpraeoptans** Sehn

(Tephritidae) Reared from fruits, (IB:377-79), (SIB:119).

Anastrepha unipuncta Sehn

An outbreak at Maricao, on "pomarrosa" fruits, July 1917. Reared from fruits, many localities recorded, (IB:377-79), (SIB:120).

HYMENOPTERA**Eucoila atriceps** Kieffer

(Figitidae) From fruit fly larva on fruit, at Las Vegas, Mayaguez, (IB:518).

Insects Affecting the Leaves and Twigs

HOMOPTERA**Nessorhinus gibberulus** Stål

(Membracidae) At Arecibo, listed (IB:74).

Philaenus fusco-varius Stål

(Cercopidae) At Bayamón, (IB:75).

Entogonia coffeaphila (Dozier)

(Cicadellidae) At Vega Alta, (IB:78).

(Fulgoridae)

Colpoptera maculifrons Muir

At Bayamón and Arecibo, (IB:100).

Eugenia

Neocolpoptera portoricensis Dozier

At Cidra, (IB:101).

Ormenis pygmaea (Fabricius)

At Corozal, (IB:102).

(Coccidae)

Vinsonia stellifera (Westwood)

At Mayagüez; at Mameyes, (IB:130), 1912.

Coccus acuminatus (Signoret)

At Corozal, (IB:130).

Coccus mangiferae (Green)

Listed (IB:131).

Saissetia hemisphaerica (Targioni)

Listed (IB:132), 1912.

Saissetia oleae (Bernard)

At Corozal, (IB:133).

Selenaspidus articulatus (Morgan)

At Corozal, (IB:139), 1912. Listed as *Pseudoaonidia articulatus* Morgan.

Chrysomphalus personatus (Comstock)

Listed (IB:140), 1913.

HYMENOPTERA

Myrmelachista ramulorum Wheeler

(Formicidae) Ants killing shoots of tree, boring in the twigs and breeding inside the bores. Infestation causing the death of more than 50 per cent of the terminals of the trees, at Lares, June 2, 1940.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels abundant on very large trees at Aguas Buenas, altitude 1,100 ft., June 2, 1940. Trees infested at Cayey and Barrio Guayabota of Yabucoa, June 1942. (LFM.) .

Eugenia**COLEOPTERA*****Apate monachus* Fabricius**

(Bostrychidae) An outbreak affecting many trees at Lares, among them: "pomarrosa," (IB:244).

LEPIDOPTERA***Psychonoctua personalis* Grote**

(Cossidae) Boring in the trunk of tree, reported by Tower, listed (IB:483).

Eugenia malaccensis (L.)

(Myrtaceae)

DISTRIBUTION: A tree, introduced and occasionally planted in Puerto Rico. Seen at St. Croix. (Many trees in "patios" of houses at Caracas, Venezuela: Martorell.) Native to Asia. (In Britton & Wilson, Vol. 6, 0. 41, as: *Jambos malaccensis* (L.) DC.)

USES: Planted for its fruit as well as for shade and ornament.

COMMON NAMES: "Manzana Malaya," "Manzana Africana," "Ohia," "Pomarrosa Malaya" and Malayan apple.

INSECT RECORDS**Insects Affecting the Fruits****DIPTERA*****Anastrepha unipuncta* Seín**

(Tephritidae) From fruits, collected at Trujillo Alto, (SIB:120).

Insects Affecting the Leaves**HOMOPTERA**

(Coccidae)

***Eucalymnatus tessellatus* (Signoret)**

At Trujillo Alto (IB:130).

***Coccus acuminatus* (Signoret)**

At Trujillo Alto (IB:130).

Eugenia

Diaspis boisduvalii Signoret

At Trujillo Alto, listed (IB:135).

Aspidiotus cyanophyllii Signoret

Listed (IB:137).

Eugenia monticola (SW.) DC.

(Myrtaceae)

DISTRIBUTION: A shrub or tree, growing in thickets and woodlands, at lower and middle elevations in moist and dry districts of Puerto Rico. Also recorded from Culebra, Vieques, St. Thomas, St. Croix, St. Jan, Tortola, Virgin Gorda, Jamaica, Cuba, Hispaniola, from St. Martin to Trinidad.

COMMON NAMES: "Hoja menuda," "Biriji," Slang berry, Red rod-wood and Black cherry.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Infested by termites or "comejenes," at Guajataca Gorge, near Quebradillas, Nov. 17, 1940. (LFM.)

Eugenia myrtiloides Poir.

(Myrtaceae)

DISTRIBUTION: A small tree, growing in coastal woods and thickets, in the dry southwestern districts of Puerto Rico. Also recorded from Mona, Muertos, Vieques, St. Croix, St. Thomas, Florida, Bahamas, Jamaica,

Eugenia

Cuba and Hispaniola. (In Britton & Wilson, Vol. 6, p. 35, as: *Eugenia buxifolia* (Sw.) Willd.)

COMMON NAMES: "Anguila" and Spanish stopper.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

(Aleyrodidae)

Aleurodicus griseus Dozier

Numerous pupae, adults and nymphal stages, collected from the foliage of trees, at Punta de Cangrejos, July 19, 1925, listed (IB:143). (Dozier.)

Eugenia stahlia (Kiaersk.) Krug & Urban

(Myrtaceae)

DISTRIBUTION: A tree, growing in our mountain forests at middle and higher elevations. Endemic. Puerto Rico.

USES: The light colored, heavy, hard and durable wood is used for ox-cart tongues, railroad ties and general construction.

COMMON NAMES: "Guayabota" and "Limoncillo."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA**Krisna insularis** Oman

(Cicadellidae) A nymph on a tender leaf of the tree, near El Yunque Rock, Luquillo Mts., about 4,000 ft. altitude, listed (SIB:51), 1940. (GNW.)

Aleurothrixus similis Sampson & Drews

(Aleyrodidae) A single leaf infested: black nymphs surrounded by a white corona. July 4, 1944, Mt. Britton, El Yunque Mts., 3,500 ft. altitude. (GNW.) Det: L. M. Russell.

Ficus

(Fulgoridae)

Neurotmata angustata Uhler

At Manatí, listed (IB:97), 1924.

(Coccidae)

Pseudococcus brevipes (Cockerell)

On aerial roots of "jagüey," attended by the ants, *Myrmelachista ramulorum* Wheeler, (IB:123), 1924.

Pseudococcus nipae (Maskell)

Heavy infestation of the coccid on leaves and twigs. Leaves all covered by a black sooty-mold. Aug. 27, 1940, Yabucoa, also at Guayama, Nov. 14, 1940. (LFM.)

Cryptostigma inquilina (Newstead)

On tree, at Manatí, attended by the ant, *Myrmelachista ramulorum* Wheeler, listed (IB:129), 1923.

Ceroplastes floridensis Comstock

At Yabucoa, listed (IB:130), 1916.

Saissetia nigra (Nietner)

Very abundant on tree, at Ponce, (SIB:59), 1936. Infestation on leaves and twigs of trees, at Maunabo, March 11, 1941, altitude 50 ft., and Salinas, March 9, 1941, altitude 700 ft.; also at Ponce, Hacienda Cintrona, Feb. 7, 1941. (GNW. & LFM.)

Saissetia oleae (Bernard)

Slight infestation on the undersides of leaves, on tree at Aibonito, Oct. 13, 1940. At Hacienda Cintrona, east of Ponce, on leaves and twigs, many of the scale insects parasitized, Feb. 7, 1941. (GNW. & LFM.)

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) At Palo Seco, feeding on leaves (IB:298), 1916. Many adults feeding on the foliage of trees, at Maunabo, Sept. 15, 1940. (LFM.)

LEPIDOPTERA

Megalopyge krugii (Dewitz)

(Megalopygidae) Caterpillars feeding on the foliage, at Ponce, Aug. 1941. (LFM.)

Ficus

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nests and tunnels on trunks of trees at Guajataca Gorge, San Sebastián, Salinas, Cayey and Yabucoa, in altitudes ranging from sea-level to 1,200 ft. 1940. (LFM.)

HYMENOPTERA**Myrmelachista ramulorum** (Wheeler)

(Formicidae) Nesting in trees, at Manatí, living in crevices in the trunk, branches, etc. (IB:555), 1922. Trees infested by the same species, observed and chemical control experiments carried on, at Manatí, during 1936-42. (GNW. & LFM.)

Ficus lyrata Warb.

(Moraceae)

DISTRIBUTION: An introduced tree, having a very limited distribution in the island of Puerto Rico. Native to Africa.

COMMON NAMES: "Palo de goma" and Lyrate-leaved fig.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA**Pseudococcus nipae** (Maskell)

(Coccidae) Undersides of leaves of large tree, completely covered by coccids, at least on the lower branches, Guayama, (SIB:58), 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Tunnels on the trunk of large tree, about 50 ft. high and 18 inches in diameter, at Guayama, Dec. 12, 1940. (LFM.)

Ficus

Ficus nekbuda Warb.

(Moraceae)

DISTRIBUTION: A tree, native to the eastern part of tropical Africa, introduced and now planted occasionally in Puerto Rico and St. Croix.

USES: The tree is planted for shade and ornament.

COMMON NAME: Bark-cloth tree.

INSECT RECORDS

Homoptera

Ceroplastes denudatus Cockerell

(Coccidae) On trees, at Muñoz Rivera Park, at Puerta de Tierra. This scale insect was probably introduced along with the tree (IB:129), 1933.

Ficus nitida Thunb.

(Moraceae)

DISTRIBUTION: A tree, native to the East Indies, planted in Puerto Rico and the Virgin Islands, along avenues, in gardens and "plazas."

USES: The wood is not locally used, but the tree is a fine ornamental, and due to its densely leafy crown it is an excellent shade tree.

COMMON NAMES: "Laurel" and "Laurel de la India."

INSECT RECORDS

Insects Affecting the Leaves

THYSANOPTERA

Gynaikothrips ficorum (Marchal)

(Pholeothripidae) On leaves of host trees, very common at San Juan, Rio Piedras and Caguas. Also at Manatí and Guayama (IB:69). On trees at Hacienda Catalina, El Yunque road, (SIB:50), 1939-40. (Listed as: *Gynaikothrips uzeli* Zimmerman.) Outbreak during the month of May, 1941, at Guayama, becoming pestiferous and troublesome to people walking around the "plaza" of the city. (LFM.)

Ficus**HEMIPTERA****Cardiastethus rugicollis** Champion

(Anthocoridae) Predaceous on thrips, on trees, listed (SIB:67).
Listed in (IB:156) as: *Cardiastethus assimilis* (Reuter).

Macrotracheliella laevis Champion

(Anthocoridae) Feeding on thrips of trees, at Caguas, (IB:156).

Macrotracheliella nigra Parshley

Predaceous on thrips, on trees, (IB:156). Commenting about this record, Mr. H. G. Barber, p. 403, says, "Dr. H. L. Dozier (Jour. Dept. Agr. P. R. 10:280, 1927) reports *M. nigra* Parshley, determined by C. J. Drake, as feeding on thrips at Juana Diaz on Jan. 11, 1925 and at San Juan, July 2, 1925. It is possible that this may be a misidentification."

LEPIDOPTERA**Pachylia ficus** (Linnaeus)

(Sphingidae) One larvae collected while feeding on the foliage of a tree at Río Piedras, May 26, 1944. (GNW.)

HYMENOPTERA**Tetrastichus tatei** Dozier

(Tetrastichidae) From *G. uzeli* Zimmerman = *G. ficorum* (Marchal) on trees, at Mayagüez, recorded by Dozier, (SIB:143).

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Icerya montserratensis Riley & Howard

At Manatí and Caguas, on trees, (IB:120).

Ceroplastes floridensis Comstock

At Caguas, listed (IB:130).

Saissetia oleae (Bernard)

Abundant on twigs of trees, at "plaza" of Guayama, May 30, 1941.

Selenaspis articulatus (Morgan)

At Caguas, (IB:131), 1915. Listed as *Pseudaonidia articulatus* Morgan.

Ficus

Chrysomphalus aonidum (Linnaeus)

At San Juan, (IB:139), 1915. Also at Caguas.

Chrysomphalus personatus (Comstock)

At San Juan, (IB:140), 1915.

Ischnaspis longirostris (Signoret)

At Caguas (IB:143). On trees, at El Yunque, (SIB:62), 1939-40.

On trees at Guayama, very abundant on leaves, May 30, 1941.
(LFM.)

HYMENOPTERA

Thysanus fax (Girault)

(Signiphoridae) Reared from *Chrysomphalus personatus* (Comstock)
on trees, at Río Piedras, listed (IB:531), 1913.

Ficus sintenisii Warb.

(Moraceae)

DISTRIBUTION: A tree, growing in the mountain forests of Puerto Rico,
at lower and middle elevations. Endemic.

USES: The wood is soft, weak and not durable. It is only used for
firewood and charcoal.

COMMON NAMES: "Jagüey" and Higuillo prieto."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Pseudococcus nipae (Maskell)

(Coccidae) Heavy infestation on a small tree, at Cayey, altitude
2,400 ft., March 11, 1941. (LFM.)

Pulvinaria psidii Maskell

(Coccidae) Infesting the leaves and twigs, slight infestation, San
Sebastián, Oct. 19, 1941. (LFM.)

Ficus

Ficus stahlii Warb.

(Moraceae)

DISTRIBUTION: A tree, growing on limestone hills, at lower elevations in Puerto Rico and Mona Island. Endemic.

COMMON NAME: "Jagüey."

INSECT RECORDS**Insects Affecting the Leaves and Twigs****HOMOPTERA**

Pseudococcus nipae (Maskell)

(Coccidae) Abundant on twigs and leaves, on trees at Manatí, Aug. 30, 1940. (LFM.)

Saissetia nigra (Nietner)

(Coccidae) Heavy infestation on twigs and undersides of leaves many trees attacked, Manatí, Aug. 30, 1941. (LFM.)

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding on the foliage, not abundant, at Camuy, on the Guajataca Lake road, Km. 5.2, Sept. 5, 1940. (LFM.)

Insects Affecting the Twigs**HOMOPTERA**

Monobelus fasciatus (Fabricius)

(Membracidae) On twigs of tree, at Manatí, (IB:75), 1923.

Epicranion championi Fowler

(Cercopidae) Mostly found on twigs, although two adults were collected in a large spittle mass on the underside of a leaf, Sept. 5, 1940, at Camuy. Dr. Oman, of the U. S. National Museum, identified the species as *Epicranion* sp. nov., and in reference to it said: "This species is recorded in IB, as *E. championi* Fowler, but the true *championi* does not occur in the West Indies apparently."

LEPIDOPTERA

Azochis rufidiscalis Hampson

(Pyraustidae) Caterpillar a twig borer, fairly abundant at times; at Maunabo 1936, and at Camuy, during Sept. and Oct. 1940. Borer destroys many shoots.

Ficus

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Large trees at Guajataca and Camuy with nests and tunnels on the trunk, Sept. 1940. (LFM.)

HYMENOPTERA

Xylocopa brasilianorum Linnaeus

(Xylocopidae) Breeding in the old trunk of a large tree at Sardinero Beach, Mona Island, April 6, 1944. (LFM.)

Genipa

Genipa americana L.

(Rubiaceae)

DISTRIBUTION: A tree, growing in woods and forests, in wet or moist districts, ascending to higher elevations, in Puerto Rico. Also recorded from Vieques, St. Thomas, St. Jan, Cuba, Hispaniola, from Guadeloupe to Trinidad and continental tropical America.

USES: The wood is strong, tough and elastic, with a specific gravity of 0.85. It is used for packing boxes, barrel hoops, shoe lasts, general construction and in all types of structure wherever strength and elasticity are required. The fruit is used in the preparation of a cooling drink or "refresco."

COMMON NAMES: "Jagua" and "Genipa."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Toxoptera aurantii (Fonscolombe)

(Aphiidae) On tree, (IB:117), 1925. Presumably on the foliage. Listed as *T. aurantiae* Koch.

Ceroplastes floridensis Comstock

(Coccidae) On tree at Guayama, (IB:130).

Genipa

Howardia biclavis (Comstock)
(Coccidae) At San Germán, (SIB:60).

LEPIDOPTERA

Aellopos tantalus (Linnaeus) var. **zonata** (Drury)
(Sphingidae) According to Möschler, p. 105, the caterpillar of this species, among other host plants lives upon *Genipa*, listed (IB:449).

Asellodes fenestraria Guenée
(Geometridae) Mr. Van Zwaluwenburg, recorded the species as breeding on tree, (IB:453). Listed as: *Hydrastocia fenestraria* Guenée.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)
(Termitidae) Tunnels and nest in a very large tree, about 50 ft., high at Barrio Guayabota, Yabucoa, altitude 1,300 ft., Aug. 25, 1940. Also at Guaynabo, altitude 200 ft., large nest on tree, the trunk with many tunnels around, May 27, 1941. (LFM.)

Gilibertia

Gilibertia arborea (L.) E. March

(Araliaceae)

DISTRIBUTION: A tree, growing in forests and on wooded hills, mostly at middle and higher elevations, in wet or moist districts of Puerto Rico. Also recorded from St. Thomas, Tortola, Jamaica, Cuba, Hispaniola, St. Vincent, Trinidad, Margarita and continental tropical America. (In Britton & Wilson, Vol. 6, p. 47 as: *Dendropanax arboreum* (L.) Dene & Pl.)

USES: The light yellow wood is hard, heavy, strong and tough. No uses are attributed to the wood of this tree, in our island.

COMMON NAMES: "Palo de cachimba," "Palo de cachumba," "Muñeca" and "Víbora."

INSECT RECORDS

Insects Affecting the Trunk

Gilibertia

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Trees attacked by the termite, at Guajataca Gorge, near Quebradillas, at Maunabo and Río Abajo Plantations, Utuado, in altitude ranging from sea-level to 1,200 ft., 1940. (LFM.)

Gleditsia

Gleditsia triacanthos L.

(Caesalpiniaceae)

DISTRIBUTION: A North American tree, introduced and planted occasionally in Puerto Rico.

COMMON NAME: Honey locust.

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA

(Coccidae)

Saissetia oleae (Bernard)

Recorded by Mr. A. Busck, at Adjuntas, Jan. 30, 1899, (IB:133).

Pseudaulacaspis pentagona (Targioni)

Recorded by Mr. A. Busck, at Adjuntas, Jan. 30, 1899, (IB:135).
(The locality is Adjuntas, and not Fajardo, as listed in IB.)

Gliricidia

Gliricidia sepium (Jacq.) Steud.

(Fabaceae)

DISTRIBUTION: A small tree, native to Central America and northern South America, widely naturalized in the West Indies; Puerto Rico,

Gliricidia

Jamaica, Cuba, Hispaniola, Trinidad and Curacao. Along roadsides and gardens, in some places in Puerto Rico growing spontaneously.

USES: The wood is reddish purple, hard, heavy and strong. It should have use in the manufacturing of furniture. The tree has been used in Puerto Rico as an ornamental, for fence posts; also makes a good support for vanilla, in plantations of this commercial crop.

COMMON NAMES: "Madre de cacao" and "Mata ratón."

INSECT RECORDS**Insects Affecting the Leaves****COLEOPTERA****Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) Adults feeding on foliage of small tree, at Barrio Aguacate, Yabueoa, May 1942. (LFM.)

Insects Affecting the Twigs**HOMOPTERA****Howardia biclavis** (Comstock)

(Coccidae) At Mayaguez, listed (IB:134), 1931.

Aphis medicaginis Koch

(Aphididae) Aphids enormously abundant on stems of flower clusters and presumably responsible for no seed being set. Loiza, March 9, 1944. (GNW. & LFM.) (Det: F. O. Essig.) Few of these aphids were found to be parasitized by *Aphidius testaceipes* (Cresson).

Grevillea*Grevillea robusta* A. Cunn.

(Protaceae)

DISTRIBUTION: A tree, native to Australia, introduced into Puerto Rico, occasionally seen along roadsides and gardens.

USES: The wood is light in color and very attractively marked, somewhat like oak. In Australia it is used for cabinet making, panelling and other interior work. The tree is planted in Puerto Rico, for shade and ornament.

Grevillea

COMMON NAMES: "Roble australiano," "Roble de seda," "Roble de plata" and Silk oak.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Aspidiotus destructor Signoret

(Coccidae) On the undersides of leaves, on a young tree, (IB:138), 1912.

COLEOPTERA

Phyllophaga citri (Smyth)

(Scarabaeidae) Adults feeding on the foliage (IB:250).

Insects Affecting the Trunk and Branches

HOMOPTERA

Asterolecanium pustulans (Cockerell)

(Coccidae) Recorded at different places on this host, (IB:122). The scale insect is responsible for nearly the total eradication of this tree species in Puerto Rico.

COLEOPTERA

Stephanoderes sp.

(Scolytidae) Reared from under the bark of a tree, listed (IB:317), 1923.

Guaiacum

Guaiacum officinale L.

(Zygophyllaceae)

DISTRIBUTION: A tree, growing in woodlands, thickets, and on plains and hillsides at low elevations in the dry southern and southwestern districts of Puerto Rico. Also recorded from Vieques, Culebra, St. Thomas, St. Croix, St. Jan, Cuba, Jamaica, Hispaniola and continental tropical America.

Guaiacum

USES: The yellowish brown, very hard and heavy wood, is strong and very durable in contact with the soil. It is valued for rollers, hubs, cogs and pulleys, furniture and general construction work.

COMMON NAMES: "Guayacán," "Guayaco" and *Lignum vitae*.

INSECT RECORDS**Insects Affecting the Leaves****ORTHOPTERA*****Microcentrum triangulatum* Brunner**

(Tettigoniidae) Eggs of this species, laid in rows on the edge of leaves and also on the trunk of a tree. Young nymphs observed, feeding on the leaves of a tree, at Salinas Beach, June 7, 1940. (LFM.)

HOMOPTERA

(Coccidae)

***Crypticerya rosae* (Riley & Howard)**

On trees, at Guánica, not very abundant, (SIB:56), 1937. (LFM.)

***Ceroplastes cirripediformis* Comstock**

On tree, the coccid controlled by a parasitic wasp, (IB:129).

(Aleyrodidae)

***Aleurothrixus floccosus* (Maskell)**

Listed (IB:146).

COLEOPTERA

(Curculionidae)

***Diaprepes abbreviatus* (Linnaeus)**

Few adult weevils feeding on the foliage of a tree, at Salinas, June 7, 1940. (LFM.)

***Lachnopus curvipes* (Fabricius)**

Abundant and causing defoliation on many trees at Salinas Beach, June 7, 1940. (LFM.)

***Apodrosus argentatus* Wolcott**

Very abundant, on the leaves of many trees, large and small, at Salinas Beach, June 7, 1940. (LFM.)

Guaiacum

LEPIDOPTERA

Kricogonia castalia (Fabricius)

(Pieridae) Caterpillar feeds on the foliage of trees, but this butterfly is very scarce in the Island, probably due to the scarcity of its host tree.

Melipotis fasciolaris (Hubner)

(Phalacnidae) Numerous caterpillars, collected under loose bark, on the trunk of a tree, at the Guánica Insular Forest, June 1, 1942. (GNW.) Reared to adults, identified by Mr. Heinrich.

Platynota sp.

(Tortricidae) Small, shiny green caterpillars, webbing the leaves of trees and feeding on the same, at Salinas Beach, June 7, 1940. Small yellowish moth reared. (LFM.)

Megalopyge krugii (Dewitz)

(Megalopygidae) Cocoons very abundant, attached to the trunk of many trees, at Salinas Beach, presumably the caterpillars feeding on the foliage, June 7, 1940.

HYMENOPTERA

Euderomphale aleurothrixii Dozier

(Entedontidae) A single female reared by Dr. Dozier from the white fly, *Aleurothrixus floccosus* (Maskell) infesting host tree, at Central Aguirre, June 28, 1925, (IB:524).

Eretmocerus portoricensis Dozier

(Aphelinidae) Reared from the white fly, *Aleurothrixus floccosus* (Maskell), infesting trees, at Central Aguirre, (IB:528).

Plagiomerus cyanea (Ashmead)

(Aphelinidae) Reared from *Ceroplastes cirripediformis* Comstock, infesting tree at Aguirre, (IB:529).

Thysanus flavus (Girault)

(Signiphoridae) Reared from *Aleurothrixus howardi* = *floccosus* (Maskell), infesting tree, at Central Aguirre, (IB:531).

Crematogaster steinheili Forel

(Formicidae) On tree, attending the coccid, *Crypticeria rosae* (Riley & Howard), at Guánica, (SIB:149), 1937. (LFM.)

Guaiacum

Insects Affecting the Trunk

HOMOPTERA**Chrysomphalus nigropunctatus** (Cockerell)

(Coccidae) Heavy infestation on trunk and larger branches, on a tree, at Salinas Beach, June 7, 1940. Other trees infested in the vicinity also.

Guaiacum sanctum L.

(Zygophyllaceae)

DISTRIBUTION: A tree, growing in coastal thickets and on hillsides, in the southwestern districts of Puerto Rico. Also recorded from Mona, Florida, Bahamas, Cuba, Hispaniola and Yucatán. Its wood resembles that of *G. officinale* L.

COMMON NAMES: "Guayancanillo," "Guayacán," "Guayacancillo," "Guayacán de vera," "Guayacán blanco," Lignum vitae and Bastard lignum vitae.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

(Curculionidae)

Apodrosus argentatus Wolcott

Feeding on the leaves of tree, at Guánica, (IB :303), 1914.

Lachnopus curvipes (Fabricius)

Abundant, feeding on the leaves, at Guánica Insular Forest, May 1942.

Guarea*Guarea trichilioides* L.

(Meliaceae)

DISTRIBUTION: A tree, growing in woodlands, forests, on river banks and along streams, at lower and middle elevations, mostly within the dry districts of Puerto Rico. Also recorded from St. Croix, Cuba, Hispaniola and continental tropical America. (In Britton & Wilson, vol. 5, p. 465 as: *Guarea Guara* (Jacq.) P. Wilson.)

USES: The reddish brown wood is used in carpentry, for wagons and implements and in general construction. It is hard, strong, tough and durable.

COMMON NAMES: "Guaraguao" and Musk wood.

INSECT RECORDS

Insects Affecting the Leaves

ORTHOPTERA

Microcentrum triangulatum Brunner

(Tetlingoniidae) Three or four adults, feeding on the foliage of trees, at Aibonito, on the Coamo road, Km. 77, Oct. 13, 1940. (LFM.)

HOMOPTERA

(Coccidae)

Pseudococcus nipae (Maskell)

Leaves and twigs, densely covered by the coccids, at Aibonito, Oct. 13, 1940. (LFM.)

Coccus viridis (Green)

Abundant on the undersides of leaves, especially near the midrib, Aibonito, Oct. 13, 1940. (LFM.)

Saissetia oleae (Bernard)

Abundant on the leaves and twigs of a large tree about 12 inches in diameter, at Aibonito, on the Coamo road, Km. 82.8, Oct. 13, 1940. (LFM.)

Ischnaspis longirostris (Signoret)

Very abundant on the undersides of leaves, causing intense chlorosis; at Aibonito, Oct. 13, 1940. Pestiferous on trees at El Verde, Río Grande, March 22, 1942. (LFM.)

Guarea

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Few adults feeding on the foliage of large tree, at Aibonito, on the Cayey road, Km. 77, Oct. 13, 1940. (LFM.)

LEPIDOPTERA

Astraptes talus (Cramer)

(Hesperiidae) According to Möschler, p. 102, the caterpillar of this species feeds on the foliage of this tree, (IB:407).

Megalopyge krugii (Dewitz)

(Megalopygidae) Numerous cocoons attached to the trunk of large tree, presumably the caterpillars or "plumillas" feeding on the foliage. Aibonito, Oct. 13, 1940. (LFM.)

Insects Affecting the Twigs

COLEOPTERA

Stephanoderes trinitatis Hopkins

(Scolytidae) Eight adults of this species were collected at Patillas, from a terminal of tree, apparently killed by the attack of the borer. May 1940. (D. DeLeón.) (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest and tunnels on tree at Guajataca, Km. 22, of the Camuy-San Sebastián road, Oct. 19, 1941. Trees with tunnels on trunks, at Río Abajo Plantations, 1,200 ft. altitude, April 20, 1941.

Guazuma

Guazuma ulmifolia Lam.

(Sterculiaceae)

DISTRIBUTION: A tree, growing in fields, forests, woodlands and on hill-sides, at lower and middle elevations in Puerto Rico. Also recorded from

Guazuma

Vieques, St. Croix, St. Thomas, Tortola, Cuba, Jamaica, Hispaniola and continental tropical America. (In Britton & Wilson, vol. 5, p. 575 as: *Guazuma Guazuma* (L.) Cockerell.)

USES: The brownish soft and tough wood has a specific gravity of about 0.6 and is used for posts and stakes. The bark yields a cordage fiber and the fruit is used as fodder for horses.

COMMON NAMES: "Guácima," "Guácimo," Bastard cedar, West Indian elm, and Jackocalalu (St. Thomas).

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Saissetia oleae (Bernard)

At Guayama and Mayagüez, (IB:133).

Pinnaspis minor (Maskell)

Recorded by Mr. A. Busck, at Guayama, Feb. 4, 1899. Listed in (IB:136) as *Hemichionaspis minor* Maskell.

LEPIDOPTERA**Oiketicus kirbyi** Guilding

(Psychidae) A single bag-worm collected, feeding on the foliage of a tree, at Salinas, Oct. 24, 1941. (LFM.)

Megalopyge krugii (Dewitz)

(Megalopygidae) Cocoons attached to the trunk of a tree, at Ponce, (SIB:138), 1940. Presumably the caterpillars fed on the foliage of the host tree. (LFM.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Large tree, with many tunnels on trunk, at Salinas, on the Cayey road, Km. 14, altitude 1,750 ft., Dec. 24, 1940. (LFM.)

COLEOPTERA**Stenodontes bituberculatus** (Beauvois)

(Cerambycidae) Adults in burrow of live tree, at Salinas, (IB:258), 1916.

Guettarda*Guettarda elliptica* Sw.

(Rubiaceae)

DISTRIBUTION: A tree, growing in thickets and on hillsides at lower elevations in the southern and eastern districts of Puerto Rico, mostly near the coast. Also recorded from Mona, Desecheo, Muertos, St. Thomas, Florida, Bahamas, Jamaica, Cuba and Hispaniola.

USES: No uses attributed to this species so far.

COMMON NAMES: Prickle wood (Br. Honduras).

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Calidota strigosa (Walker)

(Aretiidae) Caterpillar on host tree; red-brown with shining black head, (IB:416).

Guettarda scabra (L.) Vent.

(Rubiaceae)

DISTRIBUTION: A shrub or tree, growing in woods, thickets and on hillsides, at lower and middle elevations in Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Bahamas, Florida, Cuba, Jamaica, Hispaniola, Anguilla, Grenada, Trinidad, Margarita and continental tropical America. (In Britton & Wilson, vol. 6, p. 234 as: *Guettarda scabra* (L.) Lam.)

USES: Its hard wood is chiefly used for building native huts.

COMMON NAMES: "Palo de cucubano," "Serresuela" and Velvet berry.

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA

Howardia biclavis (Comstock)

(Coccidae) At Mameyes and Dorado, listed (IB:134-5), 1913

Gymnanthes*Gymnanthes lucida* Sw.

(Euphorbiaceae)

DISTRIBUTION: A shrub or small tree, growing in thickets, woodlands and hillsides, at lower and middle elevations. Recorded from Puerto Rico, Desecheo, Icacos, Culebra, Vieques, Mona, St. Croix, St. Thomas, St. Jan., Virgin Gorda, south to Guadeloupe. Also found in Florida.

USES: The timber is in local demand for poles, posts, stakes, tool handles, and small articles of turnery. Occasional shipments of small lots of the logs are sent abroad and used for backs of brushes and mirrors, walking sticks and umbrella handles, and veneers for marquetry.

COMMON NAMES: "Yaití," "Tabaco" and Crabwood.

INSECT RECORDS

Insects Affecting the Seeds

LEPIDOPTERA

Ethelgodia texanana (Walsingham)

(Olethreutidae) Reared from seeds collected at Garrochales, Arecibo, July 5, 1944. (GNW.) Det: C. Heinrich.

Grapholita sp.

(Olethreutidae) Reared from seeds collected at Garrochales, Arecibo, July 5, 1944. (GNW.) Det: C. Heinrich.

Insects Affecting the Trunk

ISOPTERA

Kaloterms (Kaloterms) snyderi Light

(Kalotermitidae) Attacking trees at Mona Island. Abundant. (LFM.)

Haematoxylon*Haematoxylon campechianum* L.

(Caesalpiniaceae)

DISTRIBUTION: A tree, growing on hillsides and in coastal woods, in the southern and western districts of Puerto Rico, at lower elevations. Also

Haematoxylon

recorded from St. Croix, St. Thomas, Tortola, Cuba, Jamaica, Hispaniola and Central America.

USES: The red, hard, strong and durable wood yields a dye known as haematoxylin. The heartwood is used in medicine as a mild astringent, especially in diarrhoea and dysentery. The wood contains about 10 per cent of tannin. The seeds are sometimes employed to flavor food.

COMMON NAMES: "Campeche," "Palo de campeche" and Logwood.

INSECT RECORDS**Insects Affecting the Seeds****HYMENOPTERA*****Tanaostigma haematoxyli* Dozier**

(Eurytomidae) Abundant in seeds, at Mayagüez, (IB:532), (Dozier).

Insects Affecting the Leaves**COLEOPTERA*****Procula ferruginea* (Olivier)**

(Coccinellidae) Apparently feeding on psyllids, which was the only possible host insect present on the tree. Eggs and larvae of the coccinellid abundant. June 1, 1942. (GNW.) Guánica Insular Forest.

***Diaprepes abbreviatus* (Linnaeus)**

(Curculionidae) Adults feeding on the foliage of trees, not very abundant, at Salinas, Oct. 20, 1940. (LFM.)

Insects Affecting the Trunk and Branches**ISOPTERA*****Nasutitermes* (N.) *costalis* (Holmgren)**

(Termitidae) Several trees with tunnels on their trunks, at Salinas, Oct. 20, 1940. (LFM.)

HOMOPTERA***Crypticerya rosae* (Riley & Howard)**

(Coccidae) Few coccids on branches of a fairly large tree, at Salinas, Oct. 20, 1940. Very abundant on a young tree, and observed on others, attended by *Solenopsis geminata* (Fabr.), May 31, 1942, at the Guánica Insular Forest. (LFM.)

Haematoxylon

HYMENOPTERA

Solenopsis geminata (Fabricius)

(Formicidae) Attending coccids, *Crypticerya rosae* (Riley & Howard), on trees, at Guánica Ins. Forest, May 31, 1942. (LFM.)

Hernandia

Hernandia sonora L.

(Hernandiaceae)

DISTRIBUTION: A tree, growing in forests in the wet or dry districts, at lower and middle elevations in Puerto Rico. Also found at Cuba, from Montserrat to Trinidad and continental tropical America.

USES: The whitish wood is light and soft. It is not locally used, but in Trinidad it is in considerable demand. The sap of this tree is said to be a satisfactory depilatory.

COMMON NAMES: "Mago" and Toporite.

INSECT RECORDS

Insects Affecting the Leaves

HEMIPTERA

(Tingitidae)

Corythucha gossypii (Fabricius)

Three adults and many nymphs on one leaf. Nymphs present on the undersides of other leaves. Mameyes, Sept. 27, 1944. (LFM. & GNW.)

Monanthia monotropidia Stål

Nymphs abundant, on the undersides of leaves, causing chlorosis, at Mameyes, Sept. 29, 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) *costalis* (Holmgren)

(Termitidae) On large tree, at Mameyes, Dec. 4, 1940. (LFM.)

Heterotrichum

Heterotrichum cymosum (Wendl.) Urban

(Melastomaceae)

DISTRIBUTION: A tree, growing in thickets, forests and on rocky hillsides in wet or moist districts of Puerto Rico, ascending to higher elevations. Endemic.

COMMON NAMES: "Terciopelo," "Camasey de paloma" and "Camasey colorado."

INSECT RECORDS

Insects Affecting the Leaves

DIPTERA

Leskiopalpus flavipennis (Wiedemann)

(Larvaevoridae) One adult reared from caterpillar, which is a leaf-folder on host tree, at El Yunque Mts., altitude 1,900 ft., Sept. 29, 1940. (LFM.)

LEPIDOPTERA

Blepharomastix ebulealis (Guenée)

(Pyraustidae) The caterpillar is a leaf-folder on this tree species. Fairly abundant, and parasitized by the fly mentioned above. El Yunque Mts., altitude 1,900 ft., Sept. 29, 1940. (LFM.)

Hura

Hura crepitans L.

(Euphorbiaceae)

DISTRIBUTION: A tree, growing in forests and on wooded hills, at lower and middle elevations in Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Cuba, Jamaica, Hispaniola and continental tropical America.

USES: The brownish white wood is soft, used for canoes and construction.

COMMON NAMES: "Havilla," "Javillo," "Javilla," "Molinillo," Sand-box tree, Monkey pistol and Monkey's dinner bell (Br. W. I.).

Hura

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Saissetia nigra (Nietner)

(Coccidae) At Mayagüez, listed (IB:133).

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) A common pest, on trees near Guayama, on the Salinas road, May and June 1940. (LFM.)

Hyeronima

Hyeronima clusioides (Tul.) Griseb.

(Euphorbiaceae)

DISTRIBUTION: A tree, growing in the mountain forests in wet or moist districts of Puerto Rico. Also recorded from Dominica, St. Vincent and Grenada. (In Britton & Wilson, vol. 5, p. 479 as: *Hyeronima clusioides* (Tul.) Muell.)

COMMON NAME: "Cedro macho."

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) A medium sized tree, with tunnels on the trunk, at Guajataca Gorge, near Quebradillas, Nov. 17, 1940. (LFM.)

Hymenaea*Hymenaea courbaril* L.

(Caesalpiniaceae)

DISTRIBUTION: A tree, growing in forests and on hillsides, mostly in moist or wet districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Cuba, Jamaica, Hispaniola, from St. Barts to Trinidad and continental tropical America.

USES: The heavy wood with a specific gravity of nearly 1.00, is red hard and tough. It is used in cabinet work and furniture. The resin known as American copal, is used in varnishes and in ointments for medicinal purposes. The fruit sometimes is used as food.

COMMON NAMES: "Algarrobo," "Courbaril," "Cuapinole," Locust tree and "Jatopa" (Brazil).

INSECT RECORDS

Insects Affecting the Fruits or Pods

COLEOPTERA**Acanthoscelides dominicanus** (Jekel)

(Bruchidae) From pods of tree at Guánica, listed (IB:287), 1911.
Listed as *Bruchus dominicanus* Jekel.

Stephanoderes buscki Hopkins

(Scolytidae) From pods, at Arecibo and Ponce, (IB:317).

LEPIDOPTERA**Myelois decolor** Zeller

(Phycitidae) Reared from the pods, at Arecibo, (SIB:133).

Insects Affecting the Leaves

HOMOPTERA**Howardia biclavis** (Comstock)

(Coccidae) Listed (IB:134), 1914.

COLEOPTERA**Exophthalmodes roseipes** (Chevrolat)

(Curculionidae) Feeding on tender leaves, at Vega Baja, (SIB:103), 1940. Listed as *Prepodes roseipes* Chevrolat.

Insects Affecting the Trunk

Hymenaea

ISOPTERA

(Termitidae)

Nasutitermes (N.) acajutlae (Holmgren)

Nest on tree, July 8, 1921, listed in (IB:49) as: *N. creolina* Banks (not a valid species). Listed (SIB:42).

Nasutitermes (N.) costalis (Holmgren)

Tunnels on trunk, on trees at Yabucoa, Ponce, Salinas and Isabela, June 1942.

Ilex

Ilex nitida (Vahl) Maxim.

(Ilicaceae)

DISTRIBUTION: A tree, growing in forests and on wooded hills in wet or moist districts, at middle and higher elevations in Puerto Rico. Also recorded from Jamaica, Montserrat, Guadeloupe, Martinique and Mexico.

USES: The wood is light-colored, fine-grained, hard and heavy. It is used for fuel and hut building.

COMMON NAMES: "Brigueta naranjo," "Cuero de sapo," "Hueso prieto" and "Palo de hueso."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Pseudococcus nipae (Maskell)

(Coccidae) Few coccids on the leaves of tree, at Cayey, near Peñon del Collao, Cayey-Salinas road, altitude 2,400 ft., March 11, 1941. (LFM.)

Ilex

Ilex sideroxyloides (Sw.) Griseb.

(Ilicaceae)

DISTRIBUTION: A tree, growing in the forests of the Sierra de Luquillo, in the eastern mountains of Puerto Rico; also recorded from Montserrat to St. Vincent.

USES: The flesh colored, hard and heavy wood, has very little use in Puerto Rico.

COMMON NAMES: "Gongolf" and Central American oak.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) A single tree at El Verde, heavily defoliated by adult weevils, altitude 1,000 ft., July 25, 1941.

Inga

Inga laurina (Sw.) Willd.

(Mimosaceae)

DISTRIBUTION: A tree, growing in woodlands, on hillsides and along streams at lower and middle elevations, mostly in moist districts of Puerto Rico. Recorded also from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Hispaniola and from St. Kitts to Grenada.

USES: The dark gray wood is hard, a little heavier than that of *Inga vera*, and is used for firewood and charcoal. The tree is widely used as coffee shade in Puerto Rico.

COMMON NAMES: "Guamá," Pomshock and Sweet pea.

INSECT RECORDS

Insects Affecting the Pods

HYMENOPTERA

Tanaostigmodes portoricensis Crawford

(Eupelmidae) From seed pods, listed (IB:532).

Inga

Insects Affecting the Leaves

HOMOPTERA

Agallia pulchra DeLong & Wolcott

(Cicadellidae) Listed (IB:76), 1922.

Entogonia coffeaphila (Dozier)

(Cicadellidae) At Cayey, Aibonito, Orocovis, Mayagüez, Jayuya, Adjuntas, mountains north of Yauco, and at El Yunque Mts., listed (IB:77).

Entogonia coffeacola (Dozier)

Listed (IB:78).

COLEOPTERA

Procula ferruginea (Olivier)

(Coccinellidae) On tree infested with psyllids, probably *Psylla minuticon* Crawford at Lares, (IB:223), 1922. Also at El Peñón del Collao, Cayey (SIB:93), 1940. Listed in both cases as *Daulis ferruginea* Olivier. (LFM.)

Exophthalmodes roseipes Chevrolat

(Curculionidae) At Lares (IB:293), 1921. Listed as *Prepodes rosicipes* Chevrolat.

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding voraciously on foliage, especially on tender growth. Jayuya Mts. 2,500 ft. altitude, Oct. 1936. Also at Naguabo, causing heavy defoliation, altitude 250 ft., May 27, 1941. (LFM.)

LEPIDOPTERA

Melipotis januaris (Guenée)

(Phalanenidae) Mr. Van Zwaluwenburg records: thousands of larvae on tree at Mayagüez, June 1917, (IB:436).

Megalopyge krugii (Dewitz)

(Megalopygidae) On trees throughout the coffee districts of Puerto Rico, (IB:505).

Insects Affecting the Twigs

Inga

HOMOPTERA

(Membracidae)

Monobelus fasciatus (Fabricius)

At Lares, (IB:74), 1921-22.

(Cercopidae)

Epicranion championi Fowler

Listed (IB:75).

Philaenus fusco-varius Stål

At Mayagüez, (IB:75), 1923.

(Fulgoridae)

Bothriocera venosa Fowler

At Lares, (IB:94), 1922.

Flatoides brunneus Muir

At Mayaguez, (IB:105).

(Coccidae)

Icerya montserratensis Riley & Howard

Listed (IB:119).

Cryptostigma inquilina (Newstead)

At San Juan, Mayagüez, and Lares (IB:129), 1922.

Pseudaonidia tesserata (de Charmoy)

At Lares, (IB:139), 1922.

Chrysomphalus personatus (Comstock)

Listed (IB:140)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest in tree, at Cayey, 1940. (LFM.)

COLEOPTERA

Xyleborus affinis Eichhoff

(Scolytidae) Appearing in lesions on the trunk of trees, caused by water soluble salts of thallium in "hormiguilla" bait, (SIB:106). (GNW.)

Inga

Platypus ratzenburgi Chapuis

(Platypodidae) Under bark of logs of *Inga laurina* at Ciales, (IB:316), 1923.

HYMENOPTERA

(Formicidae)

Monomorium carbonarium ebenium Forel

Occupying "hormiguilla" tunnels in "guamá" tree at Mayagüez deserted by "hormiguilla" after a fight with fire ants over thallium poison bait, (SIB:149).

Solenopsis geminata (Fabricius)

So weakened colony of "hormiguilla" in raids on thallium meat bait in "guamá" tree at Mayagüez, that galleries were later occupied by *Monomorium carbonarium ebenium* Forel, (SIB:149).

Myrmelachista ramulorum Wheeler

An important pest on trees throughout the coffee districts of Puerto Rico.

Insects Resting on the Tree

COLEOPTERA

(Chrysomelidae)

Cryptocephalus nigrocinctus Suffrian

At Lares (IB:267), 1922.

Cryptocephalus perspicax Weise

Ponce, Mayagüez, Aibonito and Comerío, (IB:268).

Diachus nothus (Weise)

At Adjuntas; also on tender growth, at Lares, (IB:268-69), 1922.

Omototus ferrugineus Suffrian

On tender growth of tree, at Lares, (IB:276), 1922.

Aphthona compressa Suffrian

At Mayagüez, (IB:284), 1923.

Inga

Inga vera Willd.

(Mimosaceae)

DISTRIBUTION: A tree, growing in woodlands, on hillsides and bank streams at lower and middle elevations, in moist or wet districts of Puerto Rico. Also recorded from Jamaica, Cuba, Hispaniola, from Mexico to Venezuela: continental tropical America. (In Britton & Wilson, vol. 5, p. 347 as: *Inga Inga* (L.) Britton.)

USES: The light, grey, hard and strong wood is locally employed for fuel and charcoal. The tree is widely used as a shade tree for coffee plantations in Puerto Rico.

COMMON NAME: "Guaba."

INSECT RECORDS**Insects Affecting the Pods****LEPIDOPTERA**

(Stenomidae)

***Stenoma* sp.**

In seeds, at Mayagüez, listed (IB:498).

Insects Affecting the Leaves**HOMOPTERA**

(Chermidae)

***Psylla minuticon*a Crawford**

Common on leaves of *Inga vera*, at Lares, 1922; in mountains north of Yauco, 1923; at Adjuntas and throughout the coffee districts, in (IB:111). Very abundant on the leaves of trees, especially on the tender ones, at Camp Doña Juana, altitude 1,900 ft., in the mountains north of Villalba, 1941. (LFM.)

***Psyllia martorelli* Caldwell**

Breeding on tender shoots of trees at Doña Juana Camp, mountains north of Villalba, altitude 1,900 ft. (Species described by Dr. J. S. Caldwell in Journ. N. Y. Ent. Soc., vol. LII, Dec. 1944, p. 339.)

(Coccidae)

***Icerya montserratensis* Riley & Howard**

At Lares, listed (IB:120).

Inga

Pseudococcus virgatus (Cockerell)

On tree, at San Sebastián, parasitized by *Leptomastidea antillicola* Dozier, listed (SIB:145).

Inglisia vitrae Cockerell

At Guayama, (IB:130), 1921.

Lepidosaphes crotonis (Cockerell)

At Utuado, (IB:142), 1935.

COLEOPTERA

(Chrysomelidae)

Cryptocephalus tristiculus Weise

At Mayaguez, listed (IB:267), 1923.

Cryptocephalus perspicax Weise

Feeding on the leaves, (IB:268), 1923.

Diachus nothus Weise

Listed (IB:268), 1921.

Metachroma sp.

At Adjuntas, (IB:270).

(Curculionidae)

Exophthalmodes roseipes (Chevrolat)

Listed (IB:293), 1921, as *Prepodes roseipes* Chevrolat.

Diaprepes abbreviatus (Linnaeus)

At Cidra (IB:298), 1933. Adults feeding on the foliage of trees, at Manatí, Sept. 27, 1940. (LFM.)

Lachnopus curvipes (Fabricius)

At Comerío, (IB:302), 1913.

Apodrosus wolcottii Marshall

Abundant, feeding on leaves of trees, at Cayey, (IB:303), 1923.

LEPIDOPTERA

Phoebis argante (Fabricius)

(Pieridae) Caterpillars on tree, at Cayey, (IB:404), 1921.

Eulepidotis addens (Walker)

(Phalaenidae) A small green leaf-folding caterpillar, on trees at Cayey, (IB:434), 1921. Numerous caterpillars collected, attacking tender

Inga

leaves of trees, at Cayey, at El Peñón del Collao, 2,000 ft. altitude, Dec. 30, 1940. (LFM.)

Phostria humeralis (Guenée)

(Pyraustidae) Three adults reared, out of greenish caterpillars feeding on the foliage of trees, at El Peñón del Collao, 2,000 ft. altitude, Dec. 30, 1940.

Tetralopha scabridella Ragonot

(Epipaschidae) The "guaba" leaf-webber, doing the so commonly called, "nidos de mariposas" (butterfly nests), causing tremendous defoliation of trees, during the season of the year in which they are abundant. At Lares and Cayey (IB:469), 1922. Larvae very injurious to trees, at El Peñón del Collao, altitude 2,000 ft., Cayey, Feb. 15, 1941. (LFM.)

Brenthia pavonacella Clemens

(Glyphipterygidae) Caterpillars abundant, feeding on the undersides of leaves, at Lares, Nov. 1931, (IB:485).

Trichotaphe sp.

(Gelechiidae) A small grey moth with thick orange antennae, a large black spot near base of forewings; larva a leaf-roller, (IB:488), 1923. (Determined as sp. nov.)

Acrocercops dives (Walsingham)

(Gracilariidae) Larvae mining in leaves of trees, at Lares (SIB:136), 1936.

Megalopyge krugii (Dewitz)

(Megalopygidae) Common on trees, throughout the coffee districts of Puerto Rico, (IB:505). Caterpillars feeding on the foliage of trees, at Cayey, near El Peñón del Collao, 1,900 ft. altitude, 1940. (LFM.)

HYMENOPTERA**Microbracon** sp.

(Braconidae) Reared from the leaf-miner *Acrocercops dives* (Walsingham), infesting trees, at Lares, (SIB:139), 1936. Listed as "sp. nov."

Yelicones sp.

(Braconidae) Reared from caterpillars of *Tetralopha scabridella* Ragonot, at Cayey, (IB:512), 1923.

Inga**Leptomastidea antillicola** Dozier

(Encyrtidae) A single male, reared from *Pseudococcus virgatus* (Cockerell), on tree, at San Sebastián, (SIB:145).

Insects Affecting the Twigs

HOMOPTERA

(Membracidae)

Nessorhinus gibberulus Stål

At Mayagüez, (IB:73), 1923.

(Cercopidae)

Philaenus fusco-varius Stål

At Aibonito, listed (IB:75).

(Fulgoridae)

Bothriocera venosa Fowler

At Añasco, (IB:94), 1913.

Neurotmata angustata Uhler

At Cayey, (IB:96), 1921.

Ormenis marginata (Brunnich)

At Cayey, (SIB:53), 1910.

Flatoides brunneus Muir

At Mayaguez, (IB:105). At San Sebastián, (SIB:54), 1938.

(Coccidae)

Asterolecanium ingae Russell

Listed (IB:122 as: "sp. nov."). Described by Miss Louise M. Russell (Nov. 1941, p. 111-112).

Asterolecanium pustulans (Cockerell)

At Cayey (IB:122), 1923. Presumably on the twigs and smaller branches.

Cryptostigma inquilina (Newstead)

In tunnels of "hormiguilla" on trees (IB:129).

HYMENOPTERA**Myrmelachista ramulorum** Wheeler

(Formicidae) Very common throughout the coffee districts of Puerto Rico, boring in twigs, branches and parts of the trunk, (IB:555).

Inga**Camponotus ustus** Forel

(Formicidae) In dead twigs of tree, at Utuado and Ciales, (IB:556), 1920 and 1923.

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Numerous tunnels on trunk of a large tree, at Aibonito, near the Aibonito-Coamo-Barranquitas cross, Oct. 13, 1940. Also trees attacked at Río Abajo Plantation, altitude 1,200 ft., Utuado, April 20, 1941. (LFM.)

HOMOPTERA**Lecaniodiaspis** sp.

(Coccidae) Trunk of tree, completely covered by the coccid, at Maunabo, on the Yabucoa road, altitude 500 ft., (SIB:57), 1937. (LFM.)

COLEOPTERA**Apate monachus** Fabricius

(Bostrychidae) In trunk of small tree, at San Sebastián, (IB:244), 1932. Listed as *Apate francisca* Fabr.

Neoclytus araneiformis (Olivier)

(Cerambycidae) Ovipositing in freshly cut logs, in the mountains north of Yauco, (IB:262), 1921.

Platypus excisus Chapuis

(Platypodidae) From *Inga vera* at Aibonito (IB:316), 1923.

Platypus ratzenburgi Chapuis

(Platypodidae) Under bark of logs, at Lares (IB:316), 1921.

Xyleborus affinis Eichhoff

(Scolytidae) From tree, at Aibonito (IB:318), 1923. Appearing in lesions, on the trunk of trees caused by water soluble salts of thallium in "horniguilla" bait, (SIB:106). (GNW.)

Xyleborus sacchari Hopkins

(Scolytidae) From tree, at Patillas, (IB:319), 1921.

LEPIDOPTERA**Agathodes designalis** Guenée

(Pyraustidae) Fully grown larvae boring in bark of trees, at Cayey, (IB:463), 1922.

Inga

Mea sp.

(Tineidae) Larvae making long tunnels of tough silk under bark of trees, dying from attack of *Xyleborus* beetles, at Juana Díaz (IB:503), 1934.

HYMENOPTERA

Trigonura sp.

(Chalcididae) Many adults on logs of tree, at La Indiera, (Lares-Yauco road) apparently attempting to parasitize cerambycid eggs or larvae of *Neoclytus aranciformis* (Olivier), under bark, (SIB:147), 1921.

Insects on Dead Wood

ISOPTERA

Nasutitermes (*Tenuirostritermes*) **discolor** (Banks)

(Termitidae) In rotten stump of tree at Ciales, and in a dead tree, at Lares, (IB:47), 1922. Listed as *Tenuirostritermes discolor* Banks.

COLEOPTERA

Chrysobothris tranquebarica (Gmelin)

(Buprestidae) On dead tree, at Ciales, (SIB:89), 1926.

Isandrina

Isandrina emarginata (L.) Britton & Rose

(Caesalpinaceae)

DISTRIBUTION: A tree, growing in woodlands and on hillsides at lower elevations in dry parts of the southcentral districts of Puerto Rico. Also recorded from Jamaica, Cuba, Hispaniola, Guadeloupe and from Mexico to Venezuela.

USES: Not used locally, but it is said to have purgative properties. In Jamaica it is used as a dye-wood. The leaves are applied to allay the pain of insect stings.

COMMON NAMES: "Vela muerto" (Puerto Rico), "Palo de chivo" (Santo Domingo), and "Palo hediondo" (Vera Cruz).

Isandrina**INSECT RECORDS****Insects Affecting the Leaves****ORTHOPTERA****Microcentrum triangulatum** Brunner

(Tettigoniidae) Eighteen eggs of this species, laid on the undersides of a leaf, just around the edge in a semicircular row, at Salinas, altitude 150 ft., Oct. 20, 1940. (LFM.) Presumably the young nymphs, started by feeding on the foliage.

HEMIPTERA**Corythucha gossypii** (Fabricius)

(Tingitidae) A tremendous infestation on leaves, adults and nymphal stages abundant, causing chlorosis and total defoliation of small trees, at Salinas, Oct.-Nov. 1940. (LFM.)

COLEOPTERA**Lachnopus curvipes** (Fabricius)

(Curculionidae) Adults very abundant feeding on the foliage of young trees, about 10 ft., high, altitude 300 ft., Salinas, on the Cayey road, Oct. 11, 1940. (LFM.)

LEPIDOPTERA**Anteos maerula** (Fabricius)

(Pieridae) Caterpillars defoliating trees, at Salinas, Oct. 11, 1940. Very abundant. (LFM.)

Insects Affecting the Twigs**HOMOPTERA****Icerya purchasii** Maskell

(Coccidae) One specimen collected on a twig of tree, at Salinas, Nov. 7, 1940. (LFM.)

Saissetia oleae (Bernard)

(Coccidae) Slight infestation on twigs, at Salinas, Nov. 1 1940. (LFM.)

Krugiodendron*Krugiodendron ferreum* (Vahl) Urban

(Rhamnaceae)

DISTRIBUTION: A tree, growing in thickets, woodlands and on hillsides at lower elevations, mostly in dry districts of Puerto Rico. Also at Mona, Desecheo, Icacos, Culebra, Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Anegada, Florida, Cuba, Hispaniola, Jamaica, Lesser Antilles south to St. Vincent and Bonaire.

COMMON NAMES: "Palo de hierro," "Bariaco," "Espejuelo," Black iron-wood and Ebony wood.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) On trunk of trees, many tunnels present, at Guajataca Gorge, Quebradillas, Nov. 24, 1940. (LFM.)

Lagerstroemia*Lagerstroemia speciosa* (L.) Pers.

(Lythraceae)

DISTRIBUTION: A tree, native to the East Indies, introduced into Puerto Rico and now planted along roadsides, gardens and parks.

USES: Planted as an ornamental, for its large and beautiful violet blossoms.

COMMON NAMES: "Flor de la reina," "Reina de las flores" and Queen of flowers.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

ORTHOPTERA**Microcentrum triangulatum** Brunner

(Tettigoniidae) Feeding on the foliage of trees, especially on the very tender and young growth, at Santurce, May 1940. (LFM.)

Lagerstroemia**HOMOPTERA**

(Coccidae)

Coccus viridis (Green)

Very heavy infestation on twigs and leaves, especially on the under sides of leaves, near the midrib, at Yabucoa, on the Maunabo road, altitude 500 ft., April 1941. (LFM.)

Saissetia hemisphaerica (Targioni)

Slight infestation on twigs and undersides of leaves, on trees at Patillas, May 1941. (LFM.)

Saissetia oleae (Bernard)

Infestation, especially on twigs of trees, at Patillas and also at Yabucoa, on the Maunabo road, altitude 500 ft., May 1941. (LFM.)

COLEOPTERA**Phyllophaga portoricensis** (Smyth)

(Scarabaeidae) Adults defoliating young tree, about 10 ft. high, at Santurce, May 1942. Beetles feeding at night, some collected, while hiding in the soil at the base of the tree. (LFM.)

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Beetles feeding on the foliage of trees, at Santurce, Río Piedras and Yabucoa, Oct. 1941. (LFM.)

HYMENOPTERA**Solenopsis geminata** (Fabricius)

(Formicidae) Attending scale insects, especially *Coccus viridis* (Green), on trees, at Yabucoa, altitude 500 ft., April 1941.

Laguncularia

Laguncularia racemosa (L.) Gaertn.

(Terminaliaceae) ' .

DISTRIBUTION: A tree, growing in coastal swamps in Puerto Rico. Also recorded from Mona, Vieques, St. Croix, St. Thomas, St. Jan, Anegada,

Laguncularia

Florida, Cuba, Jamaica, Hispaniola, continental tropical America and West tropical Africa.

USES: The wood is used for fence posts and charcoal. The bark contains about 14 per cent tannin, and is used for tanning skins. It is also employed for medicinal purposes as an astringent and tonic.

COMMON NAMES: "Mangle blanco," "Mangle bobo" and White mangrove.

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA**

(Coccidae)

Ceroplastes floridensis Comstock

At Fajardo, (IB:130), 1923.

Chrysomphalus personatus (Comstock)

Listed (IB:140), 1914.

Pseudoparlatoria parlatorioides (Comstock)

On leaves of trees, at Faro de Cabo Rojo, (SIB:62), 1937.

(Aleyrodidae)

Metaleurodicus sp.

Abundant, breeding on the undersides of leaves, many trees infested at Ponce, (El Pastillo) and Arceibo (El Vigía), during May to September 1941. (GNW. & LFM.) (The insect was determined as "sp. nov.")

Insects Affecting the Trunk**ISOPTERA****Nasutitermes** (N.) **costalis** (Holmgren)

(Termitidae) Nests and tunnels, on trees, at Camp Piñones, Boca de Cangrejos, Sept. 15, 1940. (LFM.)

LEPIDOPTERA**Psychonoctua personalis** Grote

(Cossidae) Caterpillar abundant on tree trunks, at Boca de Cangrejos, (SIB:135), 1938.

Lawsonia*Lawsonia inermis* L.

(Lythraceae)

DISTRIBUTION: A shrub, growing spontaneous after cultivation in many parts of Puerto Rico, St. Croix, and St. Thomas. Cultivated in many districts of Mexico also. A native of the Old World tropics, probably of Asia or Africa.

USES: The plant is not used locally, except as an ornamental. The leaves of this shrub are used in the Orient for staining the nails, hands and feet yellow, as well as dying the hair and beard. A perfume is obtained from the flowers, which was employed by the early Egyptians for embalming. The fruit has medicinal properties.

COMMON NAMES: "Resedá," Egyptian privet, Mignonette tree and Henna plant.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Vinsonia stellifera (Westwood)

(Coccidae) Listed (IB:130), 1916.

Saissetia hemisphaerica (Targioni)

(Coccidae) Listed (IB:132), 1916. Branches and twigs of a small shrub, heavily infested, at Maunabo, Oct. 23, 1940. (LFM.)

Leptoglottis*Leptoglottis portoricensis* (Urban) Britton & Rose

(Mimosaceae)

DISTRIBUTION: A shrub, growing in thickets and woodlands, in the vicinity of Coamo. Apparently local; an endemic species.

COMMON NAMES: "Zarzilla" and "Zarzarilla."

Leptoglottis

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Listed by Mr. E. G. Smyth, on this tree, presumably feeding on the foliage, (IB:298).

LEPIDOPTERA

Atethmia subusta (Hübner)

(Phalaenidae) Listed (IB:427), 1913. Presumably feeding on the foliage. (Listed as *Bagisara subusta* Hübner.)

Noropsis hieroglyphica (Cramer)

(Phalaenidae) Caterpillar on tree, according to Mr. Van Zwaluwenburg, (IB:435).

Melipotis ochrodes (Guenée)

(Phalaenidae) At Yauco, on tree, (IB:436). Presumably the caterpillar feeding on the foliage.

Leucaena

Leucaena glauca (L.) Benth.

(Mimosaceae)

DISTRIBUTION: A shrub or small tree, growing in woodlands and thickets, at lower and middle elevations, especially in the dry sections of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan., Tortola, Virgin Gorda, Greater Antilles to Florida, tropical continental America and Old World tropics.

USES: Its brownish, hard and durable wood furnishes a good fuel and charcoal. The green pods are edible, the seeds are used for ornamental purposes and the tree in some parts of the World is used for hedges and coffee shade. Its foliage is said to be poisonous to horses and mules,

Leucaena

causing shedding of hairs in tails and manes, if they are allowed to feed too freely on its leaves and pods.

COMMON NAMES: "Zarcilla," "Acacia," "Acacia pálida," Wild tamarind, Tantan and Lead tree.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trunk of trees; at the Guánica Ins. Forest
Oct. 25, 1940. (LFM.)

Linociera

Linociera domingensis (Lam.) Knobl.

(Oleaceae)

DISTRIBUTION: A tree growing on wooded hills and in forests, in wet or moist districts of Puerto Rico. Also recorded from Jamaica, Cuba and Hispaniola. (In Britton and Wilson, vol. 6, p. 78 as: *Maycepa domingensis* (Lam.) Krug & Urban.)

USES: The wood is light in color, hard, and of little use in the Island.

COMMON NAMES: "Hueso blanco," "Huesillo," "Palo de hueso" and "Palo blanco."

INSECT RECORDS

Insects Affecting the Trunk

COLEOPTERA

Apate monachus Fabricius

(Bostrychidae) A borer in branches of tree, reported by Mr. Van Zwaluwenburg, (IB:243).

Livistona

Livistona chinensis R. Br.

(Arecaceae)

DISTRIBUTION: A palm, planted in gardens, in Puerto Rico and the Virgin Islands. Native of China.

USES: Planted for ornamental purposes.

COMMON NAMES: "Palma de Borbón" and Bourbon palm.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Cerataphis lataniae (Boisduval)

(Aphididae) Various records, listed, (IB:119), 1919 and 1923.

Pseudococcus nipae (Maskell)

(Coccidae) Listed (IB:127), 1918.

LEPIDOPTERA

Homaledra sabalella (Chambers)

(Cosmopterygidae) On palm leaves, eating the lower sides and webbing together the excrement for a shelter; at times so common, as to turn the leaves brown, (IB:486).

Lonchocarpus

Lonchocarpus domingensis (Pers.) DC.

(Fabaceae)

DISTRIBUTION: A tree, growing on hillsides and river banks, in the western and southern districts of Puerto Rico. Also recorded from Cuba, Hispaniola, Guadeloupe, Trinidad, Martinique and Jamaica.

USES: The wood is used for fuel.

COMMON NAME: "Genogeno."

Lonchocarpus**INSECT RECORDS****Insects Affecting the Leaves****HEMIPTERA****Corythucha gossypii** (Fabricius)

(Tingitidae) Trees so badly infested, as to cause chlorosis of the foliage. Nymphs in all stages and adults very abundant, on the undersides of the leaves, Sta. Isabel, altitude 60 ft., 1940. (LFM.)

COLEOPTERA**Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) Many small trees defoliated by the attack of the adult weevils, Santa Isabel, altitude 60 ft., 1940. (LFM.)

LEPIDOPTERA**Phostria martyralis** (Lederer)

(Pyraustidae) Green caterpillars, feeding on the foliage and webbing leaves. Parasitized by braconid wasps, of the genus *Apanteles*. Many trees in the vicinity attacked, Guayanilla, Dec. 4, 1940. (LFM.)

HYMENOPTERA**Apanteles** sp.

(Braconidae) One specimen reared, parasitizing the caterpillar of *Phostria martyralis* (Lederer), at Guayanilla, Dec. 4, 1940. This parasite is parasitized by a minute wasp. (LFM.) (det.: Muesebeck.)

Syntomosphyrum sp.

(Tetrastichidae) Hyperparasites reared from the cocoons of *Apanteles* sp. parasitizing the caterpillars of *Phostria martyralis* (Lederer), at Guayanilla, Dec. 4, 1940. (LFM.)

Lonchocarpus glaucifolius Urban

(Fabaceae)

DISTRIBUTION: A small tree, growing in mountain woodlands and on hillsides in the western districts of Puerto Rico. Endemic.

COMMON NAME: "Geno."

Lonchocarpus

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on the trunk of trees, at Aguadilla, Nov. 26, 1940. (LFM.)

Lonchocarpus latifolius (Willd.) H.B.K.

(Fabaceae)

DISTRIBUTION: A tree, growing in woodlands, in moist or wet districts of Puerto Rico. Also recorded from Jamaica, Cuba, Hispaniola, from St. Kitts to Trinidad and continental tropical America.

USES: The wood is reddish with occasionally dark streaks and is used for the making of furniture.

COMMON NAMES: "Hediondo" and "Palo seco."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Phostria martyralis (Lederer)

(Pyraustidae) Leaf-webber on host tree, very abundant on trees near the coast, at Bajo de Patillas, Maunabo, 1941. (LFM.)

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Feeding voraciously on the foliage and edges of young tender pods, at Playa de Humacao, May 27, 1941. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on the trunk of a tree, about 12 ft. high and 8 inches in diameter, at Bajo de Patillas, Maunabo, 1941. (LFM.)

Lucuma

Lucuma multiflora A. DC.

(Sapotaceae)

DISTRIBUTION: A tree, growing in forests and woodlands, in wet or moist districts, at lower and middle elevations in Puerto Rico. Also recorded from St. Croix, St. Thomas and from Saba to Trinidad.

USES: The hard, strong and durable wood, is valued for furniture, house building, frames, etc.

COMMON NAMES: "Jácana" and Contrevent.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Large trees attacked at Guajataca Gorge, near Quebradillas, Nov. 17, 1940. (LFM.)

Malpighia

Malpighia fucata Ker-Gawl.

(Malpighiaceae)

DISTRIBUTION: A shrub or a small tree, growing in thickets and woodlands, at lower and middle elevations in Puerto Rico. Also in Vieques, St. Thomas, St. Croix and Jamaica.

COMMON NAMES: "Olaga" and "Palo Bronco."

INSECT RECORDS

Insects Affecting the Leaves

ORTHOPTERA

Microcentrum triangulatum Brunner

(Tettigoniidae) Eggs laid on the midrib, at the underside of a leaf, Maunabo, 1941. (LFM.)

LEPIDOPTERA

Brachycorene arcas (Drury)

(Hesperiidae) One adult reared from caterpillars feeding on the foliage, Maunabo, Dec. 27, 1940. (LFM.)

Mammea*Mammea americana* L.

(Clusiaceae)

DISTRIBUTION: A tree, growing in forests and on hillsides, in moist or wet districts of Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Tortola, Cuba, Jamaica, Hispaniola and continental tropical America.

USES: Commonly planted in Puerto Rico and the Virgin Islands, for shade and for its fruit. The reddish brown, hard and durable wood, has a specific gravity of about 0.9; is used for house building, posts and piles. The gum obtained from the bark is used to extract chiggers from the skin and to kill ticks and other parasites on domestic animals. The powdered seeds as well as the leaves are said to possess medicinal properties.

COMMON NAMES: "Mamey," Mammee apple and Mammee.

INSECT RECORDS

Insects Affecting the Seeds

COLEOPTERA

Sitophilus oryza (Linnaeus)

(Curculionidae) In seed, at Isabela, (IB:316), 1932.

LEPIDOPTERA

Myelois notatilis (Walker)

(Phycitidae) Larvae completely destroying seeds, at Mayagüez, (SIB:133).

Insects Affecting the Leaves

HOMOPTERA

(Cicadellidae)

Hybla maculata McAtee

From "mamey" at Barceloneta and Punta Cangrejos, listed (IB:92). Presumably on the foliage.

(Aphiidae)

Toxoptera aurantii (Fonscolombe)

Infesting leaves, at different localities, at Plantaje, Salinas and Las Marías, (IB:117).

Mammea

(Coccidae)

Icerya montserratensis Riley & Howard

One coccid collected on a leaf, at San Sebastián, Nov. 25, 1940. Many of them on leaves, partly parasitized by *Rhyssalus brunneiventris* Ashmead, at San Sebastián, altitude 900 ft., Feb. 4, 1941. (GNW. & LFM.)

Pseudococcus nipae (Maskell)

At Barceloneta (IB:127); slight infestation on the foliage of a young tree, at Quebradillas, Sept. 5, 1940. (LFM.)

Saissetia hemisphaerica (Targioni)

At Vega Baja, (IB:132), 1916.

Howardia biclavis (Comstock)

At Barrio Mameyes, listed (IB:133), 1912.

Pseudaulacaspis pentagona (Targioni)

At Naguabo, listed (IB:136), 1914; as *Aulacaspis pentagona* Targioni.

Aspidiotus destructor Signoret

At Plantaje, listed (IB:138), 1916.

Chrysomphalus personatus (Comstock)

At Plantaje, Mameyes and Cupey Alto, (IB:140), 1912 and 1916.

HYMENOPTERA

(Formicidae)

Solenopsis geminata (Fabricius)

Attending aphids, *Toxoptera aurantii* (Fonscolombe) on "mamey," at Ciales, (IB:545), 1921.

Crematogaster steinheili Forel

Attending aphids, *Toxoptera aurantii* (Fonscolombe) on "mamey," at El Plantaje, (IB:546), 1922.

Rhyssalus brunneiventris Ashmead

(Braconidae) Parasitizing *Icerya montserratensis* Riley & Howard, on "mamey" leaves, at San Sebastián, altitude 900 ft., Feb. 4, 1941. (GNW.)

Mangifera*Mangifera indica* L.

(Anacardiaceae)

DISTRIBUTION: A large tree, growing in fields, on hillsides, along roadsides and in river valleys, spontaneous after planting, in Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Tortola, Florida, Cuba, Jamaica, Hispaniola, continental tropical America and the Old World tropics. Native to tropical Asia.

USES: The wood is used for the same purposes as the common american ash (*Fraxinus*); that is, for gunstocks, tool handles, window frames, etc. The tree is widely planted in Puerto Rico, for its fruit and shade, its wood also used as fuel in bakeries.

COMMON NAMES: "Mangó," and Mango.

INSECT RECORDS**Insects Affecting the Fruits****DIPTERA****Anastrepha mombinpraeoptans** Seín

(Tephritidae) Reared at Río Piedras, from some mango varieties, reared in other localities, Bayamón, Guaynabo, Coamo, Guayama, Aibonito and Mayagüez, (IB:377) and (SIB:119).

Insects Affecting the Leaves**THYSANOPTERA****Selenothrips rubrocinctus** (Giard)

(Thripidae) Pestiferous on mango foliage, doing considerable damage, (IB:65).

HOMOPTERA

(Aphiidae)

Aphis gossypii Glover

A few on mango, (IB:114), 1933.

Toxoptera aurantii (Fonscolombe)

Listed (IB:117), 1933.

(Coccidae)

Asterolecanium pustulans (Cockerell)

Listed (IB:122).

Mangifera**Pulvinaria psidii** Maskell

Listed (IB:128), 1912. Common on mango foliage, especially on the lower branches. (LFM.)

Ceroplastes floridensis Comstock

Listed (IB:130).

Vinsonia stellifera (Westwood)

At Mayaguez and Santa Isabel, listed (IB:130). Fairly abundant on the foliage, but not doing damages of economic importance, apparently. (LFM.)

Eucalymnatus tessellatus (Signoret)

Listed (IB:130).

Coccus hesperidum Linnaeus

Listed (SIB:59), 1939, on leaves of tree, at Fajardo and Mayaguez.

Coccus mangiferae (Green)

Listed (IB:131).

Chionaspis citri (Comstock)

Listed (IB:134).

Pseudaulacaspis pentagona (Targioni)

At Mayaguez, listed (IB:137); as *Aulacaspis pentagona* Targioni.

Leucaspis indica Marlatt

At Mayaguez, (IB:137).

Aspidiotus cyanophylli Signoret

Listed (IB:137).

Chrysomphalus dictyospermi (Morgan)

Listed (IB:140), 1912.

Furcaspis biformis (Cockerell)

At Río Piedras, (IB:140). Listed as *Targionia biformis* Cockerell.

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nest on tree, at Ponce, (IB:49). Nests and tunnels on trunks of trees, at Vega Baja, Aug. 30, 1940. A very common insect on mangoes, in nearly all sections of the Island. (LFM.)

Mangifera

COLEOPTERA

Chlorida festiva (Linnaeus)

(Cerambycidae) Larvae bores in branches of trees, and often in the trunk, listed (IB:259).

Brentus volvulus Fabricius

(Brentidae) Under bark of tree, at Añasco, (IB:288), 1913. The larva probably bored the trunk.

Xyleborus inermis Eichhoff

(Scolytidae) In mango, (IB:318).

HYMENOPTERA

Mymelachista ramulorum Wheeler

(Formicidae) Listed (IB:555). Living in large mango tree, killing many shoots by boring in them, at Lares, altitude 1,270 ft., Dec. 10, 1941.

Manilkara

Manilkara bidentata (A. DC.) Chev.

(Sapotaceae)

DISTRIBUTION: A tree, growing in forests and on wooded hills, at lower and middle elevations in wet or moist districts of Puerto Rico. Also recorded from St. Jan and Tortola. (In Britton & Wilson, vol. 6, p. 72 as: *Manilkara nitida* (Sessé & Moc.) Dubard.)

USES: The dark-brown or brownish red wood is hard, strong and durable, and is used in construction of mallets, wheel cogs, wooden mortars, house construction, etc.

COMMON NAMES: "Ausubo" and Bullet wood.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Entogonia coffeacola (Dozier)

(Cicadellidae) Adults and nymphs abundant on the undersides of leaves and young twigs, of small trees 4 to 10 ft., high, at the forest, Barrio Espino, San Lorenzo, altitude 1,500 ft., Aug. 25, 1940. (LFM.)

Manilkara**Neocolpoptera portoricensis** Dozier

(Fulgoridae) One specimen collected on a twig, at Barrio Espino, San Lorenzo, altitude 1,500 ft., Aug. 25, 1940. (LFM.)

Saissetia oleae (Bernard)

(Coccidae) On twigs of young tree, Barrio Espino, San Lorenzo, altitude 1,500 ft., Aug. 25, 1940. (LFM.)

Manilkara plectana (Pierre) Cronquist

(Sapotaceae)

DISTRIBUTION: A tree, growing in coastal thickets and on river banks in moist or wet districts of Puerto Rico and Vieques. Endemic. (In Britton & Wilson, vol. 6, p. 72 as: *Manilkara duplicata* (Sessé & Moc.) Dubard.)

USES: The strong and durable wood resembles that of *M. bidentata* (A. DC.) Chev., and has its same uses.

COMMON NAMES: "Sapota de costa," "Sapote," "Sapote de costa," "Zipote," "Balata" and "Mameyuelo."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA**Pulvinaria psidii** Maskell

(Coccidae) Common on the undersides of leaves, at Arecibo, near sea-level, on El Vigía-Islote road, Jan. 2, 1941. (LFM.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Trees with tunnels on their trunks, at Guajataca Gorge, near Quebradillas, Oct. 1940. (LFM.)

Melia*Melia azedarach* L.

(Meliaceae)

DISTRIBUTION: A tree, commonly spontaneous after planting in Puerto Rico. Recorded also from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, southeastern United States, Bermuda, Cuba, Jamaica, Hispaniola, Mexico and continental tropical America. Native to southern Asia.

USES: The brownish wood is weak, soft, coarse-grained, used for handles of tools and implements. The tree is used as an ornamental.

COMMON NAMES: "Alilaila," "Lilaila," "Pasilla," "Alilayo," Chinaberry, Pride of India, Hog-bush (Br. W. I.). Also called Lilac in the Virgin Islands.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA**Saissetia nigra** (Nietner)

(Coccidae) At Fortuna, near Ponce and Luquillo, (IB:133), 1912-13.

Pinnaspis minor (Maskell)

(Coccidae) At Luquillo and Fortuna, near Ponce, (IB:136-7) 1912-13, listed as *Hemichionaspis minor* Maskell. Fairly large tree, infested, leaves, twigs, branches and even the trunk, at Guajataca Lake, 1941. (LFM.)

Insects Affecting the Trunk

COLEOPTERA**Apate monachus** Fabricius

(Bostrychidae) Van Zwaluwenburg, reports the insect, as boring in branches of host tree, (IB:243).

Melicocca*Melicocca bijuga* L.

(Sapindaceae)

DISTRIBUTION: A tree, occasionally spontaneous after planting in Puerto Rico, along roadsides, gardens and "patios." Also recorded from St.

Melicocca

Croix, St. Thomas, St. Jan, Cuba, Jamaica and Hispaniola. Native of continental tropical America.

USES: Planted for its edible fruit and shade.

COMMON NAMES: "Quenepa," "Quenepas" (Puerto Rico), "Mamón," "Mamoncillo" (Venezuela), Knipa, Kneiper, Quenepe, Genep tree, Genipe, Ginep, Jamaica Bullace plum and Kanappy. (Jamaica and the Br. W. I.)

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Pseudococcus virgatus (Cockerell)

(Coccidae) Listed, (SIB:58).

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Listed by Mr. E. G. Smyth, in (IB:298). Presumably feeding on the foliage.

LEPIDOPTERA

Phoebis statira neleis (Boisduval)

(Pieridae) Caterpillars on tender leaves, in July 1936, June 1937, Sept. 1939, (SIB:123).

Megalopyge krugii (Dewitz)

(Megalopygidae) Thousands of cocoons attached to the trunk of trees, at Ponce, the caterpillars feeding on the foliage previously, 1940. (LFM.)

HYMENOPTERA

Spilochalcis eubule (Cresson)

(Chalcididae) Reared from chrysalis of *Phoebis statira neleis* (Boisduval), on tree, (SIB:147). 1939.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Many trees with tunnels on their trunks, at Ponce and Guayanilla, May 1941. (LFM.)

COLEOPTERA

Stenodontes bituberculatus (Beauvois)

(Cerambycidae) A very large tree at Ponce, with many bores, done by the larvae of this species. One adult collected Nov. 14, 1940. (LFM.)

Metopium

Metopium brownei (Jacq.) Urban

(Anacardiaceae)

DISTRIBUTION: A tree, growing in coastal woods and thickets in the western and southwestern districts of Puerto Rico. Also recorded from Mona, Florida, Bahamas, Cuba and Hispaniola. (In Britton & Wilson, vol. 5, p. 510 as: *Metopium toxiferum* (L.) Krug & Urban.

COMMON NAMES: "Cedro prieto," "Papayo," Poison wood and Hog plum (Br. W. I.).

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) On tree, at Guajataca, near Quebradillas, Nov. 24, 1940. (LFM.)

Kalotermes (K.) snyderi Light

(Kalotermitidae) Infesting the dead branches of live trees, abundant. Mona Island, April 5, 1944. (GNW. & LFM.)

COLEOPTERA

Strataegus barbigerus Chapin

(Scarabaeidae) Male and female from the base of a tree, at Mona Island, (SIB:98), 1939. (LFM.)

Miconia

Miconia prasina (Sw.) DC.

(Melastomaceae)

DISTRIBUTION: A shrub or a small tree, growing in mountain forests, thickets, valleys and on hillsides, in wet or moist districts, ascending to higher elevations in Puerto Rico. Also recorded from Tortola, Jamaica, Cuba, Hispaniola, Grenada, Trinidad, Margarita and continental tropical America.

Miconia

USES: Wood used for poles, fuel and charcoal. The plant is said to yield a black dye.

COMMON NAME: "Camasey."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Pseudococcus nipae (Maskell)

Listed (IB:127), 1913. Abundant on the undersides of leaves, on trees at Aguas Buenas, altitude 1,000 ft., Nov. 19, 1940. (LFM.)

Coccus viridis (Green)

Heavy infestation of twigs and on the undersides of leaves, on trees at Aguas Buenas, altitude 1,000 ft., Nov. 19, 1940. (LFM.)

Miconia racemosa (Aubl.) DC.

(Melastomaceae)

DISTRIBUTION: A shrub, occasionally a tree, growing in woodlands, thickets and on banks in wet or moist districts of Puerto Rico, ascending to higher elevations. Also recorded from Jamaica, Hispaniola, Grenada, Tobago, Trinidad and northern South America.

COMMON NAME: "Camasey racemoso."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA**Phyllophaga citri** (Smyth)

(Scarabaeidae) Adults feeding on the foliage of tree, (IB:250).

Micropholis

Micropholis garcinifolia Pierre

(Sapotaceae)

DISTRIBUTION: A tree, growing in the forests, at high altitudes and limited to the eastern mountains of Puerto Rico. Endemic.

USES: Its very hard and fine-grained wood, is used in general construction work.

COMMON NAME: "Caimitillo."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Pseudococcus nipae (Maskell)

(Coccidae) Common on the undersides of leaves, many trees infested, at Camp Guavate, Cayey, May 17, 1940. (LFM.)

Montezuma

Montezuma speciosissima Sessé & Moc.

(Malvaceae)

DISTRIBUTION: A tree, growing in woods and on hillsides, at lower elevations in the central and western districts of Puerto Rico. An endemic species, erroneously attributed to Mexico.

USES: Its valuable wood is hard, durable, brown or reddish brown in color, strong and heavy; used for furniture, interior house work, musical instruments, posts and piles.

COMMON NAME: "Maga."

INSECT RECORDS

Insects Affecting the Seeds or Pods

HEMIPTERA

(Pyrrhocoridae)

Dysdercus andreae (Linnaeus)

Adults and nymphs on crushed pods, on the ground, (F. Seín, July 1935); at Isabela on May and June (IB:164), 1932. Feeding on the seeds of trees, (SIB:71). An important pest of "maga" seeds.

Montezuma**Dysdercus sanguinarius** Stål

Feeding on seeds, (SIB:71). (Fife.)

COLEOPTERA**Hypothenemus parvus** Hopkins

(Scolytidae) At Vega Alta, from pods, listed (IB:318). Identified as sp. near *parvus* Hopkins.

LEPIDOPTERA**Pectinophora gossypiella** (Saunders)

(Gelechiidae) An important pest, the caterpillar destroying the seeds of trees, in many sections of the Island. Many localities recorded, (IB:496) and (SIB:136).

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Membracidae)

Nessorhinus gibberulus Stål

At Villalba, (SIB:50), 1940.

(Cicadellidae)

Empoasca (Idona) minuenda Ball

Listed (IB:91), (SIB:52). Presumably on the foliage.

Dikraneura (Hyloidea) depressa McAtee

On the undersides of leaves at Bayamón, both nymphs and adults abundant, also at Vega Baja, (IB:92). At Arecibo, (SIB:52), 1940. Very abundant on the undersides of leaves, at Arecibo, Isabela, Manatí, Aibonito, Cayey, from 100 ft. to 1,500 ft. altitude, Aug. 1940. (LFM.)

(Fulgoridae)

Catonia cinerea Osborn

At Arecibo, listed (IB:93) and (SIB:53).

Ormenis quadripunctata (Fabricius)

Breeding on the undersides of leaves; eggs, nymphs and adults abundant, at Aibonito, Km. 82.8, on the Coamo road, Oct. 13, 1940. (LFM.)

Cedusa santaclara Myers

At Arecibo, (IB:105) and (SIB:54).

Montezuma

(Coccidae)

Asterolecanium pustulans (Cockerell)

At Dorado, listed (IB:122), 1934. At Isabela, Arecibo, Vega Alta, Cayey and Corozal, causing withering of leaves and killing many twigs and smaller branches, (SIB:57), 1940. Many branches killed on trees, at Guajataca Lake, Quebradillas, altitude 600 ft., Feb. 4, 1941. (GNW. & LFM.)

Asterolecanium sp.

At Vega Alta, listed (SIB:57). Determined as: "sp. nov."

Pseudococcus citri (Risso)

At Vega Alta, (IB:125), and (SIB:58).

Saissetia nigra (Nietner)

At Manatí and Ciales, (IB:133), 1915. At Vega Alta (SIB:59). Scale insects on twigs, at Guajataca Lake, altitude 600 ft., Feb. 4, 1941. On leaves at Camuy, Jan. 11, 1941. (LFM.)

Saissetia oleae (Bernard)

At Vega Baja and Villalba, (SIB:59-60), 1940. (LFM.)

Pseudaulacaspis pentagona (Targioni)

At Espinosa, Bayamón (IB:136), 1915. Listed as *Aulacaspis pentagona* Targioni.

Pinnaspis minor (Maskell)

At Isabela, (IB:137) and (SIB:60). Listed as *Hemichionaspis minor* Maskell, in (IB:137).

HEMIPTERA

Hyaloides vitreus Distant

(Miridae) In (IB:154) and (SIB:66). Presumably on the foliage.

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Weevils feeding on the foliage of trees, at Isabela, May 1942. (LFM.)

LEPIDOPTERA

Gonitis praeurupta Möschler

(Phalaenidae) Adult reared, from caterpillar collected feeding on leaves of tree, at Toa Baja, Aug. 30, 1940, (det.: Gates Clark). (LFM.)

Montezuma**Oiketicus kirbyi** Guilding

(Psychidae) Three or four bag-worms collected, while feeding on the foliage, at Aibonito, Oct. 13, 1940.

HYMENOPTERA**Euplectrus** sp.

(Elachertidae) Reared from a caterpillar feeding on leaves of tree, at Isabela, Sept. 15, 1940. The caterpillar, was determined by Dr. Wolcott, as *Anomis* sp. (GNW. & LFM.)

Moringa

Moringa oleifera Lam.

(Moringaceae)

DISTRIBUTION: A tree, introduced and growing spontaneously after planted in Puerto Rico. Much planted along roadsides. A native of the Orient. (In Britton & Wilson, vol. 5, p. 337 as: *Moringa Moringa* (L.) Millsp.)

USES: The seeds of the tree yield the lubricating oil of ben, used for lubrication as well as perfume manufacturing. The wood is very soft and weak, and of no use in Puerto Rico. However, it has many uses, in its native home.

COMMON NAMES: "Ben," "Angela," "Jazmín francés," "Hoja de sen" and Horseradish tree.

INSECT RECORDS

Insects Affecting the Pods

ISOPTERA**Nasutitermes** (N.) **costalis** (Holmgren)

(Termitidae) Trees so heavily infested by the termite, that the tunnels were all over the trunks, branches, and even in the dry pods, the termites boring and living inside. Guayama, May 1942. (LFM.)

Moringa

HOMOPTERA

Saissetia nigra (Nietner)

(Coccidae) Few, on pods of tree, at Salinas, altitude 100 ft., Oct. 20, 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Trees so heavily infested by termites, at Guayama and Salinas road, that all parts of the trees, were affected. May, 1942. (LFM.)

Myrcia

Myrcia citrifolia (Aubl.) Urban

• (Myrtaceae)

DISTRIBUTION: A tree, growing in thickets, forests and on hillsides, at lower and middle elevations in wet or moist districts of Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Cuba, St. Martin and from Saba to Barbados.

COMMON NAME: "Hoja menuda."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Ceroplastes cirripediformis Comstock

At Algarrobo, listed (IB:129), 1914. Host tree listed as *M. paniculata* = *citrifolia* (Aubl.) Urban.

Howardia biclavis (Comstock)

At Dorado, (SIB:60).

Aspidiotus sp.

At Palo Seco, listed (SIB:61).

Myrica**HYMENOPTERA****Aphycus eruptor** Howard

(Encyrtidae) Reared from *Ceroplastes cirripediformis* Comstock at Algarrobo, (IB:529), 1914. (det. as sp. nov. near *eruptor* Howard.)

Myrcia deflexa (Poir) DC.

(Myrtaceae)

DISTRIBUTION: A tree, growing in woodlands, forests and thickets, in wet or moist districts of Puerto Rico, ascending to higher elevations. Also recorded from Cuba, Hispaniola, Guadeloupe to Trinidad and northern South America.

USES: The reddish, hard, heavy and strong wood, has very little use, except for fuel and charcoal.

COMMON NAMES: "Cieneguillo" and "Guayavacón."

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA**Saissetia hemisphaerica** (Targioni)

(Coccidae) Listed (IB:132), 1915.

Myrica*Myrica cerifera* L.

(Myricaceae)

DISTRIBUTION: A shrub or tree, growing in thickets and on hillsides, in moist districts at lower and middle elevations, in Puerto Rico. Also recorded from southeastern United States, Bermuda, Bahamas, Cuba and Hispaniola.

Myrica

USES: The tree yields a wax, which has been used in the manufacturing of candles.

COMMON NAMES: "Cerero," "Arrayán," Wax-berry and Bayberry.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Aleurodicus griseus Dozier

(Aleyrodidae) Whiteflies abundant, on trees at Guánica Ins. Forest, May 31, 1942. (LFM.)

COLEOPTERA

Aphthona maculipennis Jacoby

(Chrysomelidae) At Guánica (IB:284). The host tree listed as *Myrcia cerifera*, undoubtedly an error; it should be *Myrica cerifera* L.

Nectandra

Nectandra coriacea (Sw.) Griseb.

(Lauraceae)

DISTRIBUTION: A tree, growing in woods, on hillsides and along creeks at lower elevations in dry or moist districts of Puerto Rico. Also recorded from Vieques, St. Thomas, St. Croix, St. Jan, Tortola, Florida, Jamaica, Cuba, Hispaniola and Yucatán.

COMMON NAMES: "Avispillo" and "Laurel."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Pseudococcus nipae (Maskell)

(Coccidae) Infestation on the undersides of leaves, on tree, at La Catalina, El Yunque road, altitude 600 ft., Sept. 29, 1940. (LFM.)

Nectandra

Nectandra membranacea (Sw.) Griseb.

(Lauraceae)

DISTRIBUTION: A tree, growing in forests and on hillsides, in wet or moist districts, ascending to higher elevations in Puerto Rico. Also recorded from St. Thomas, St. Croix, Jamaica, Hispaniola and from Guadeloupe to Trinidad.

COMMON NAMES: "Laurelillo," "Laurel" and "Laurel geogo."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Pseudococcus nipae (Maskell)

(Coccidae) Abundant on the foliage of many trees, especially on the undersides of leaves, at Aibonito, Km. 85.4, of the Aibonito-Coamo road, Oct. 13, 1940. (LFM.)

LEPIDOPTERA

Jocara majuscula (Herrich-Schaffer)

(Epipaschidae) Leaf-webber, very abundant, the caterpillars parasitized by a wasp, *Apanteles* sp., at Aibonito, Oct. 13, 1940.

Nectandra sintenisii Mez

(Lauraceae)

DISTRIBUTION: A tree, growing in the forests, at lower and middle elevations, in wet or moist districts of Puerto Rico. Also recorded from St. Thomas and Hispaniola.

COMMON NAMES: "Laurel blanco," "Laurel amarillo," "Laurel macho," "Laurel geo" and "Laurel."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Ormenis marginata (Brunnich)

(Fulgoridae) Adults abundant on twigs and leaves of a large tree, at Km. 26.6 of the Río Piedras-Caguas Road, Río Piedras, Oct. 20, 1940. (LFM.)

Nectandra**Pseudococcus nipae** (Maskell)

(Coccidae) In all cases, very abundant on the foliage, especially on the undersides of the leaves, at Camp Patillas, May 14, 1940; Cayey, Oct. 13, 1940; Río Piedras, Oct. 20, 1940; El Yunque Mts., Sept. 29, 1940; ranging in altitudes from 300 to 1,400 ft. (LFM.)

Aleuroplatus vinsonioides (Cockerell)

(Aleyrodidae) Several on the undersides of leaves, on tree near Caguas, on the Gurabo road, May 1942. (LFM.)

LEPIDOPTERA**Jocara majuscula** (Herrich-Schaffer)

(Epipaschidae) Caterpillars leaf-webbers on trees, at Cayey, on the Salinas road, altitude 1,800 ft., Dec. 24, 1940. One moth reared, pupation period 10 days. (LFM.)

Megalopyge krugii (Dewitz)

(Megalopigidae) Many cocoons attached to the trunk of a tree, at Km. 4.7 of the Caguas-Gurabo road, near Caguas. The caterpillars presumably fed on the foliage of this tree. Oct. 20, 1940. (LFM.)

Insects Affecting the Trunk**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Tunnels on trunks of trees, at Río Abajo Plantations, Utuado, April 20, 1941, altitude 1,200 ft. (LFM.)

Neowashingtonia

Neowashingtonia robusta (Wendl.) Britton

(Arecaceae)

DISTRIBUTION: A palm, native to the southern California deserts, occasionally planted in Puerto Rico, after its introduction.

USES: Grown for ornamental purposes.

COMMON NAMES: "Palma del desierto" and Desert palm.

Neowashingtonia

INSECT RECORDS

Insects Affecting the Seeds

COLEOPTERA**Coccotrypes rollinae** Hopkins

(Scolytidae) In seeds of palm, listed (SIB:106), 1933.

Insects Affecting the Leaves

HOMOPTERA**Aspidiotus cyanophyllii** Signoret

(Coccidae) Listed (IB:137), host palm as: *Washingtonia robusta*.

Ischnaspis longirostris (Signoret)

(Coccidae) Listed (IB:143), host as: *Washingtonia robusta*.

Aleurodicus cocois (Curtis)

(Aleyrodidae) Abundant in all stages on palm, at the Río Piedras Agr. Exp. Station, during Nov. and Dec. 1924, (IB:144).

Ochroma*Ochroma lagopus* Sw.

(Bombacaceae)

DISTRIBUTION: A tree, growing in forests, woodlands and on hillsides, at lower elevations in Puerto Rico. Also recorded from Martinique, St. Vincent, Tobago, Trinidad, Jamaica, Cuba, Hispaniola, Guadeloupe and northern South America. (In Britton & Wilson, Vol. 5, p. 569 as: *Ochroma pyramidale* (Cav.) Urban.)

USES: The very light wood is nearly white, soft, and with a specific gravity of only 0.2. It is used for stoppers, floats, rafts and otherwise as a substitute for cork. The bark yields tannin and a fiber, used in rope making. The wooly interior of the fruit is used for stuffing pillows and mattresses.

COMMON NAMES: "Guano," Balsa or Corkwood.

Ochroma

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Cryptocephalus nigrocinctus Suffrian

(Chrysomelidae) Many adults feeding on the foliage, at Cayey, Aug. 11, 1940.

LEPIDOPTERA

Pantographa limata (Grote & Robinson)

(Pyraustidae) A leaf-roller in balsa, rolling leaves and feeding, at El Yunque Mts., on the Naguabo Range, altitude 1,800 ft., Sept. 28, 1940. Many of the caterpillars were parasitized by a braconid, *Chelonus insularis* Cresson. Same caterpillars attacking trees, at Patillas, on the San Lorenzo road, about 600 ft. in altitude, Dec. 19, 1941. (det.: Heinrich.) (LFM.)

Oiketicus kirbyi Guilding

(Psychidae) Trees almost completely defoliated, at La Catalina, on El Yunque Rd., altitude 700 ft., many bags hanging on the twigs and smaller branches of trees, Sept. 29, 1940. (LFM.)

Insects Affecting the Twigs

HOMOPTERA

Asterolecanium pustulans (Cockerell)

(Coccidae) Listed (IB:122), 1924.

HYMENOPTERA

Mercetiella reticulata Dozier

(Encyrtidae) Reared from *Asterolecanium pustulans* (Cockerell), a scale insect on tree, (IB:530), 1914.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trunk of large tree, at Río Abajo Plantations, 1,200 ft. altitude, April 20, 1940. (LFM.)

Ocotea*Ocotea floribunda* (Sw.) Mez

(Lauraceae)

DISTRIBUTION: A tree, growing in the forests, at lower and middle elevations in wet or moist districts of Puerto Rico. Also recorded from St. Jan, Tortola, Cuba, Jamaica, Hispaniola, Guadeloupe, Martinique, Trinidad, Central and South America.

COMMON NAME: "Laurel."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA***Pseudococcus nipae* (Maskell)**

(Coccidae) Abundant on the undersides of leaves, at El Yunque Mts., some trees infested, Sept. 29, 1940. Altitude 1,000 ft. (LFM.)

Ocotea leucoxydon (Sw.) Mez

(Lauraceae)

DISTRIBUTION: A tree, growing in thickets, forests and on hillsides, in wet or moist districts of Puerto Rico, ascending to higher elevations. Also recorded from St. Thomas, Tortola, Cuba, Jamaica, Hispaniola and from Guadeloupe to Grenada.

COMMON NAMES: "Cacaïllo," "Laurel geo," "Laurel bobo," and "Laurel geogeo."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA***Ceropsylla martorelli* Caldwell**

(Chermidae) A leaf infesting psyllid, causing pustules on the foliage, all stages especially abundant on the tender leaves of trees. At Aguas Buenas, 1,200 ft. altitude, June 1940; at Cerro de Punta, Jayuya, 3,100 ft., Jan. 26, 1941; at Cayey, altitude 1,200 (Las Cruces) and at Maricao Insular Forest, at 2,300 ft., altitude, May 1942. (LFM)

Ocotea

Aleuroplatus vinsonioides (Cockerell)

(Aleyrodidae) On foliage of trees, at Río Abajo Plantations, 1,200 ft. in altitude, April 20, 1940. (LFM.)

LEPIDOPTERA

Jocara majuscula (Herrich-Schaffer)

(Epipaschidae) Not a very serious infestation; caterpillars webbing leaves of trees, at Cayey, on the Salinas road, altitude 1,800 ft.; at Arecibo, June 10, 1941. (LFM.) (determined as sp. prob. *majuscula* (H.-S.).

Ocotea portoricensis Mez

(Lauraceae)

DISTRIBUTION: A tree, endemic to the mountain forests of Puerto Rico.

COMMON NAMES: "Laurel," "Laurel geo," "Laurel avispillo."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Ormenis marginata (Brunnich)

(Fulgoridae) Abundant on twigs of trees, at Camp Patillas, Patillas, May 15, 1940. (LFM.)

Ceropsylla martorelli Caldwell

(Chermidae) The pustule producing psyllid, infesting leaves of trees, at Cayey, Carite Unit, altitude 2,000 ft., Aug. 11, 1940. (LFM.)

Toxoptera aurantii (Fonscolombe)

(Aphiidae) On the young shoots of tree, controlled by the fungus, *Acrostalagmus albus*, according to Mr. Van Zwaluwenburg, (IB:117).

Pseudococcus nipae (Maskell)

(Coccidae) On the undersides of leaves and twigs, at Maricao and Ciales, (SIB:58), 1940. At Cayey, Carite Unit, 2,000 ft. altitude, Aug. 11, 1940. (LFM.)

Ocotea**Saissetia oleae** (Bernard)

(Coccidae) On twigs, at Camp Patillas, Patillas, May 15, 1940.
(LFM.)

COLEOPTERA**Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) Adults feeding on the foliage of tree, at Guavate Camp, Carite Unit, Cayey, Aug. 11, 1940. (LFM.)

Ormosia

Ormosia krugii Urban

(Fabaceae)

DISTRIBUTION: A tree, growing in the primeval forests of Puerto Rico at middle and higher elevations. Also found in Dominica.

USES: The wood is light, soft and weak and finds little use, except as firewood.

COMMON NAMES: "Palo de matos," "Peronía," and "Palo de peronía."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA**Megalopyge krugii** (Dewitz)

(Megalopygidae) Cocoons abundant on the trunk of a large tree, at La Catalina, on the Yunque Mts. road, altitude 900 ft., Sept. 29, 1940. Presumably the caterpillars of this insect fed on the foliage of the tree.
(LFM.)

Oxandra

Oxandra lanceolata (Sw.) Baill.

(Annonaceae)

DISTRIBUTION: A tree, growing in woods and thickets, near Quebradillas and Cabo Rojo, Puerto Rico.

Oxandra

USES: The yellow wood is light, durable and elastic; valued for rods, spars and shafts.

COMMON NAMES: "Haya prieta," Black lancewood or Tree lancewood. (Br. W. I.)

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Gonodonta maria Guenée

(Phalaenidae) According to Moschler, p. 183, the caterpillar of this species, among other trees, lives on *Bocagea virgata* = *O. lanceolata* (Sw.) Baill.

Pariti

Pariti tiliaceum (L.) Hil.

(Malvaceae)

DISTRIBUTION: A tree, growing in thickets, along forest borders, and on banks, ascending to higher elevations in Puerto Rico. Also recorded from St. Thomas, St. Jan, St. Croix, Florida, Bermuda, Cuba, Jamaica, Hispaniola, continental tropical America and Old World tropics.

USES: The hard, strong, durable wood is greenish; used for furniture, railroad ties and in general construction. The fibrous bark is used in rope and cordage making.

COMMON NAMES: "Majagua," "Emajagua," "Esmajagua," Blue or Mountain mahoe (Br. W. I.), "Majot," "Mahot franc" (Haiti) and "Hau" (Hawaii).

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Cicadellidae)

Empoasca sexmaculata DeLong

Causing yellowing of leaves, adults, large and small nymphs present, at Punta de Cangrejos, Jan. 13 and May 29, 1920, (IB:91).

Pariti

Hybla maculata McAtee

At Cayey and Mona Island, causing yellowing of leaves, adults and nymphs in all stages, very abundant on the undersides of the leaves, on many trees, at both localities, (SIB:53), 1940. (LFM.)

(Coccidae)

Pseudococcus adonidum (Linnaeus)

On the undersides of leaves, at Cayey, (SIB:58), 1940. (LFM.)

Pseudaulacaspis pentagona (Targioni)

At Fajardo; also at Mameyes and Adjuntas, listed in (IB:135), as: *Aulacaspis pentagona* Targioni.

Pinnaspis minor (Maskell)

At Cayey, on twigs, branches and even on the trunk, (SIB:60), 1940. Large tree, at the U. S. Forest Service grounds, at Río Piedras, with slight infestation on leaves and twigs, controlled by the lady-bird beetle, *Chilocorus cacti* (Linnaeus), Feb. 13, 1941. (LFM.)

HEMIPTERA

Paracarnus cubanus Bruner

(Miridae) Abundant on the undersides of the leaves, at Cayey, (SIB:66), 1940.

Insects Affecting the Trunk

HOMOPTERA

Pinnaspis minor (Maskell)

(Coccidae) Abundant on the trunk of a very large tree, at the U. S. Forest Service grounds, controlled by the lady-bird beetle, *Chilocorus cacti* (L.) Feb. 13, 1942.

COLEOPTERA

Chilocorus cacti (Linnaeus)

(Coccinellidae) Adults and larvae, abundant, feeding voraciously on the scale insect, *Pinnaspis minor* (Maskell), infesting large tree, at the U. S. Forest Service grounds, at Río Piedras, Feb. 13, 1942. (LFM.)

Parkinsonia*Parkinsonia aculeata* L.

(Caesalpiniaceae)

DISTRIBUTION: A tree, growing in the valleys and on the plains, in moist or dry situation, in the eastern and southern districts, near the coasts, in Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, southern United States, Cuba, Jamaica, Hispaniola, continental tropical America and the Old World tropics.

USES: Often planted for ornament, highly decorative when in bloom. In other parts of the world, the wood is used for fuel, and also has been employed in paper manufacturing. The infusion of the leaves is employed in Mexico as a febrifuge and sudorific, a remedy for epilepsy and an abortifacient.

COMMON NAMES: "Palo de rayo," "Flor de rayo," "Flor de Mayo," Jerusalem thorn and Horsebean.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA**Melipotis acontoides** (Guenée)

(Phalaenidae) Caterpillars feeding on the foliage, adults reared from them, (SIB:127), 1937. The lepidopteron, *Stictoptera penicillum* Herrich-Schaffer, listed on (IB:430) should be included here, because it refers to *M. acontoides* (Guenée). The name *S. penicillum* is a misidentification.

Insects Resting on the Tree

HEMIPTERA**Alcaeorrhynchus phymatophorus** (Beauvois)

(Pentatomidae) At Faro de Cabo Rojo, (SIB:79), 1937. Possibly feeding on the foliage.

Peirania*Peirania polyphylla* (Jacq.) Britton & Rose

(Caesalpiniaceae)

DISTRIBUTION: A shrub or a small tree, growing in thickets and on hill-sides, at low and middle elevations, mostly in dry sections of the south-

Peiranisia

western and southern districts of Puerto Rico. Also recorded from St. Thomas, St. Croix, Anegada and Hispaniola.

USES: Due to its beautiful blossoms, the tree is grown as an ornamental.

COMMON NAMES: "Hediondilla," "Retama" and "Retama prieta."

INSECT RECORDS**Insects Affecting the Leaves****COLEOPTERA****Ectmesopus vitticollis** Blake

(Chrysomelidae) At Ponce, (SIB:100). Presumably feeding on the foliage.

Deloyala guttata (Olivier)

(Chrysomelidae) At Ponce, listed (IB:285) as: *Chirida guttata* Olivier. Perhaps feeding on the foliage.

Apodrosus argentatus Wolecott

(Curculionidae) At Juana Díaz (IB:303). Perhaps feeding on the foliage.

Persea

Persea gratissima Gaertn.

(Lauraceae)

DISTRIBUTION: A tree, growing spontaneous after its introduction, in Puerto Rico. Also recorded from St. Croix and St. Thomas. A native of Mexico. (In Britton & Wilson, vol. 5, p. 318 as: *Persea Persca* (L.) Cockerell.)

USES: Widely planted in tropical and subtropical regions for its edible fruit, which yields a valuable oil, used for burning and soap making. A large number of therapeutic qualities are attributed to the leaves and bark. The reddish brown wood, which is rather soft and weak, has very little use locally.

COMMON NAMES: "Aguacate," Avocado, Alligator pear and Butter pear. (Br. W. I.)

Persea

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Cicadellidae)

Empoasca (Idona) minuenda Ball

Abundant on the undersides of leaves, at Río Piedras, (Dozier). At Loíza, (IB:91), 1924.

(Fulgoridae)

Oliarus franciscanus (Stål)

At Villalba, listed (IB:96).

Ormenis infuscata Stål

Listed (IB:102), 1912.

Ormenis quadripunctata (Fabricius)

Listed (IB:103), 1912.

(Coccidae)

Pseudococcus nipae (Maskell)

Abundant on the undersides of leaves and on the twigs of trees, at different localities in Puerto Rico, (IB:126).

Ceroplastes floridensis Comstock

Listed (IB:130), 1918.

Saissetia hemisphaerica (Targioni)

Recorded by Dr. Dozier, on avocado, also controlled by the parasitic wasp, *Aneristus ceroplastae* Howard, (IB:132).

Aonidiella orientalis (Newstead)

Listed (SIB:60).

Aspidiotus destructor Signoret

At Mameyes, 1916 and at Guayama 1913, (IB:138).

Pseudischnaspis bowreyi (Cockerell)

Listed (IB:140).

Furcaspis biformis (Cockerell)

At Río Piedras, in (IB:140), listed as *Targionia biformis* Cockerell.

Persea**COLEOPTERA****Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) Listed (IB:298), 1917. Heavy defoliation by adults at Yabucoa, Aguadilla, Guajataca and Isabela, May-June 1941. (LFM.)

LEPIDOPTERA**Oiketicus kirbyi** Guiling

(Psychidae) According to Möschler, p. 122, this species feeds on the foliage of trees (IB:502).

HYMENOPTERA**Aneristus ceroplastae** Howard

(Aphelinidae) Reared from *Saissetia hemisphaerica* (Targioni) on avocado, (IB:529). (Dozier.)

Lecanobius cockerelli Ashmead

(Eupelmidae) Reared from *Saissetia oleae* (Bernard) on avocado, (IB:532). (Dozier.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nests and tunnels on trunk of many trees at Santurce, Rio Piedras, Cayey, Guayama, Ponce, Guajataca, Aguadilla, and Isabela, 1941. (L.F.M.)

COLEOPTERA**Apate monachus** Fabricius

(Bostrychidae) An outbreak at Lares, attacking many trees, and among them, avocado, (IB:244). Listed as *Apate francisca* Fabricius.

Petitia

Petitia domingensis Jacq.

(Verbenaceae)

DISTRIBUTION: A tree, growing in woods and on hillsides, at lower and middle elevations, in moist districts of Puerto Rico. Also recorded from St. Croix, Bahamas, Cuba, Cayman Islands and Hispaniola.

Petitia

USES: The brown wood, is used for rollers, furniture and general construction. It is hard, heavy, durable and of a beautiful tone when polished and varnished.

COMMON NAMES: "Capá blanco," "Capá amarillo," "Capá rosa," "Capá," "Capá de sabana," "Palo de capá" and Bastard stopper.

INSECT RECORDS**Insects Affecting the Leaves****ORTHOPTERA*****Microcentrum triangulatum* Brunner**

(Tettigoniidae) Eight or twelve adults feeding voraciously on leaves of a tree, some nymphs present also, at San Lorenzo, Aug. 25, 1940, altitude 300 ft. (LFM.)

HEMIPTERA***Paracarnus cubanus* Bruner**

(Miridae) Not very abundant, on the undersides of leaves, on trees at San Lorenzo, altitude 300 ft., Aug. 25, 1940. (LFM.)

LEPIDOPTERA***Pilocrocis secernalis* (Möschler)**

(Pyraustidae) The "capá" leaf-webber, abundant and doing damages of considerable importance. At Aguas Buenas, on the Aguas Buenas-Río Piedras road, altitude 400 ft., Dec. 15, 1940; at San Sebastián, altitude 1,000 ft.; very abundant at Guánica, altitude 100 ft., Dec. 1940. (LFM.)

***Hyblaea puera* (Cramer)**

(Hyblaeidae) An extensive outbreak in nurseries at Cayey, controlled by means of lead arsenate, (SIB:134), 1939. (LFM.)

***Oiketicus kirbyi* Guilding**

(Psychidae) At San Sebastián, feeding on the foliage, 1,000 ft., altitude, (SIB:137), 1940. (LFM.)

HYMENOPTERA***Microgaster* sp.**

(Braconidae) Only one adult reared from a caterpillar of the "capá" leaf-webber, *Pilocrocis secernalis* (Möschler), collected at Maunabo, Jan. 24, 1941. (det.: Muesebeck, "as sp. nov.") (LFM.)

Petitia

Insects Affecting the Twigs

HOMOPTERA**Ormenis marginata** (Brunnich)

(Fulgoridae) Few nymphs and adults, on twigs, San Lorenzo, altitude 300 ft., Aug. 25, 1940. (LFM.)

Saissetia oleae (Bernard)

(Coccidae) On twigs and branches, not very abundant, at Aguas Buenas, Dec. 15, 1940, altitude 400 ft. (LFM.)

LEPIDOPTERA**Terastia meticulosalis** Guenée

(Pyraustidae) Caterpillar boring in twigs of tree, at Maunabo, (SIB:131), 1938. (LFM.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Tunnels on trunk of several young trees, along the roadsides, at Aguas Buenas, on the Río Piedras-Aguas Buenas road, altitude 400 ft., Dec. 15, 1940.

Phoebe

Phoebe elongata (Vahl) Nees

(Lauraceae)

DISTRIBUTION: A tree, growing in the woods and forests, in wet or moist districts of Puerto Rico. Also recorded from St. Croix, Cuba, Hispaniola, and from Montserrat to Trinidad.

COMMON NAMES: "Laurel," "Laurel bobo" and "Avispillo."

Phoebe

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

***Pseudococcus nipae* (Maskell)**

(Coccidae) Infesting the leaves, especially on the undersides, not very abundant, at Cayey, on Km. 5.4 of the Cayey-Salinas road, 1,400 ft. altitude, Oct. 20, 1940. (LFM.)

LEPIDOPTERA

***Jocara majuscula* (Herrich-Schaffer)**

(Epipaschidae) Caterpillar a leaf-webber on tree, altitude 1,500 ft., at Cayey, on the Salinas road, Dec. 24, 1940. The caterpillar is parasitized by a species of *Apanteles*. (LFM.)

HYMENOPTERA

***Apanteles* sp.**

(Braconidae) Reared from caterpillar of *Jocara majuscula* (Herrich-Schaffer), the leaf-webber on this tree, collected at Cayey, Dec. 24, 1940. (det.: Muesebeck.) (LFM.)

Phoenix

Phoenix dactylifera L.

(Arecaceae)

DISTRIBUTION: An introduced palm, which has been occasionally planted in Puerto Rico and the Virgin Islands. It grows best in the dry southwestern districts of the Island.

USES: Mainly planted for its fruit; but date cultivation has not been successful here. Sometimes grown in gardens as an ornamental.

COMMON NAMES: "Dátil" and Date palm.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

***Aspidiotus destructor* Signoret**

(Coccidae) Listed in (IB:137).

Picramnia

Picramnia pentandra Sw.

(Simarubaceae)

DISTRIBUTION: A shrub or a small tree, growing in woodlands, river valleys and along creeks, at lower and middle elevations in Puerto Rico. Also recorded from St. Thomas, Tortola, Florida, Cuba, Jamaica and Hispaniola.

USES: The wood is used in house building.

COMMON NAMES: "Guarema," "Hueso," "Hueso prieto," "Palo de hueso" and Bitter bush.

INSECT RECORDS

Insects Affecting the Dead Wood

COLEOPTERA

***Apate monachus* Fabricius**

(Bostrychidae) Mr. Van Zwaluwenburg, reports the insect as boring in dry posts of this tree species, (IB:243). Listed as *Apate francisca* Fabricius.

Piper

Piper aduncum L.

(Piperaceae)

DISTRIBUTION: A shrub or tree, growing in thickets and on hillsides, at lower and middle elevations in Puerto Rico and Vieques. Also recorded from Cuba, Jamaica, Hispaniola, St. Vincent to Trinidad and continental tropical America.

USES: The tree is of little economic importance, only the larger stems being occasionally used in the framework of country houses.

COMMON NAMES: "Higuillo" and "Hoja menuda."

INSECT RECORDS

Insects Affecting the Leaves

Piper

COLEOPTERA

Peridinetus concentricus (Olivier)

(Curculionidae) Adults feeding on the leaves, at Patillas Camp, Patillas, May 1941. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) On trees, tunnels on the trunk and branches at Río Abajo Plantations, Utuado, April 20, 1941. Altitude 1,200 ft. (LFM.)

Piper amalago L.

(Piperaceae)

DISTRIBUTION: A shrub or a small tree, growing in woods, thickets, on hillsides and river banks, at lower and middle altitudes in Puerto Rico. Also recorded from Vieques, St. Thomas, St. Croix, St. Jan, Tortola, Cuba, Trinidad and continental tropical America.

COMMON NAMES: "Higuillo de limón" and Soot-soot.

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Altica occidentalis Suffrian

(Chrysomelidae) Adult flea-beetles, very abundant on the foliage of shrubs, at Guajataca Gorge, but apparently not feeding upon this tree species. Nearby plants of *Croton humilis* L., their host plant, were fully covered by the beetles too. Presumably the insects were spreading from the *Croton* to every shrub, weed or tree in the vicinity. Nov. 17, 1940. (LFM.)

Peridinetus concentricus (Olivier)

(Curculionidae) Abundant on host shrubs, cutting small, round holes on the leaves; larvae boring the stems, at Vega Alta, Espinosa, Corozal,

Piper

Loiza and Cayey, (IB:307), 1917-22. Also at Cayey, Guajataca Gorge and Aguas Buenas, in altitudes ranging from sea-level to 1,200 ft., Nov. 1940. (LFM.)

LEPIDOPTERA**Gonodonta nitidimacula** Guenée

(Phalaenidae) At Cayey, (IB:441), 1922. Caterpillars abundant on very small shrubs of this species at Guajataca Gorge, Oct. 24, 1940. Reared to adults. (LFM.)

Insects Affecting the Twigs

HOMOPTERA**Ormenis pygmaea** (Fabricius)

(Fulgoridae) At Vega Baja, (IB:103). Abundant on branches, at Guajataca Gorge, Nov. 17 and Oct. 24, 1940. (LFM.)

Pseudoparlatoria ostreata Cockerell

(Coccidae) At Manatí (IB:141), 1931.

Piscidia.*Piscidia piscipula* (L.) Sarg.

(Fabaceae)

DISTRIBUTION: A tree, growing in coastal thickets and on hillsides near Fajardo and along the southern coast of Puerto Rico, extending north to Punta Guaniquilla. Also found at Culebra, Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Florida, Cuba, Jamaica and Hispaniola. (In Britton & Wilson, Vol. 5, p. 409 as: *Ichthyomethia piscipula* (L.) Hitchc.)

USES: The yellowish hard and durable wood has a specific gravity of about 0.9, and is very durable in contact with the soil. The branches of the tree, when thrown into water, stupify fish.

COMMON NAMES: "Ventura" and Dogwood.

INSECT RECORDS

Insects Affecting the Leaves

Piscidia

HOMOPTERA

Euphalerus nidifex Schwarz

(Chermidae) Adults on watershoots, at Punta Cangrejos and Yauco, 1923. Nymphal skins common on host at Boquerón and Punta Cangrejos, (IB:111).

HEMIPTERA

Corythucha gossypii (Fabricius)

(Tingitidae) On tree, at Vieques, (SIB:71), 1940. (GNW.)

LEPIDOPTERA

Acolastus amyntas (Fabricius)

(Hesperiidae) Caterpillars feed on the foliage of this tree; many collected at Boquerón and Punta Cangrejos, (IB:407), 1923.

Insects Affecting the Seeds

COLEOPTERA

Caryedes sp.

(Bruchidae) From seeds collected at St. Thomas, Virgin Islands, by D. DeLeón, June 1940. Heavy infestation, many weevils as well as parasitic wasps reared from collected material. Species identified by Mr. Bridwell of the U. S. National Museum. Mr. Bridwell says, "I think this species is probably, *Bruchus podagricus* Fabricius" (Note: This is not a Puerto Rico record.) (Reared by LFM.)

HYMENOPTERA

Urosigalphus bruchi Crawford

(Braconidae) From the seeds of host tree, infested by the bruchid, *Caryedes* sp. The wasp is presumably a parasite of the larva of the weevil. Material collected by D. DeLeón and reared by L. F. Martorell. St. Thomas, Virgin Islands, June 1940. (Note: This is not a Puerto Rico record.)

Pisonia

Pisonia albida (Heimmlerl) Britton

(Nyctaginaceae)

DISTRIBUTION: A tree, growing on limestone hills and coastal thickets at lower elevations in dry districts of Puerto Rico, Mona and Muertos. Endemic.

Pisonia

USES: The wood is light and soft and is only used as fuel.

COMMON NAMES: "Corcho" and "Palo bobo."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

COLEOPTERA

Lachnopus curvipes (Fabricius)

(Curculionidae) Adult weevils feeding on the foliage of a tree, at Guánica Insular Forest, Aug. 21, 1941. (LFM.)

LEPIDOPTERA

Oiketicus kirbyi Guilding

(Psychidae) Collected on twigs of tree at Mona Is., April 6, 1944. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Very susceptible to the attack of this termite, many trees infested at the Guánica Insular Forest; also at Guajataca Gorge, near Quebradillas, Oct. and Nov. 1940. (LFM.)

Pisonia subcordata Sw.

(Nyctaginaceae)

DISTRIBUTION: A tree, growing in thickets, forests and on hillsides, ascending to higher elevations in Puerto Rico. Also recorded from Icacos, Culebrita, Vieques, St. Thomas, St. Croix, Tortola, Anegada, St. Martin to Martinique.

USES: The wood is very soft, light and weak and has little use except for fuel.

COMMON NAMES: "Corcho," "Palo bobo," Lobloloy and Water Mampoo.

INSECT RECORDS

Insects Affecting the Trunk

Pisonia

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) On trees, at Guajataca, tunnels on the trunk, Nov. 17, 1940. (LFM.)

Pithecellobium

Pithecellobium arboreum (L.) Urban

(Mimosaceae)

DISTRIBUTION: A tree, growing in woodlands and on river banks, at lower and middle elevations, mostly in moist districts of Puerto Rico. Also recorded from Hispaniola, Cuba, Jamaica, Mexico and Central America.

USES: Locally, the wood is of little use. The wood is said to be of excellent quality, and is much used in some parts of the West Indies and Central America, for flooring, ceiling, posts, etc.

COMMON NAMES: "Acacia silvestre," "Cojoba" and "Cojóbana."

INSECT RECORDS

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on the trunk of large trees, at Guajataca Gorge, near Quebradillas, Nov. 17, 1940. (LFM.)

Pithecellobium dulce (Roxb.) Benth.

(Mimosaceae)

DISTRIBUTION: A tree, native to tropical America, from Mexico to Venezuela. Introduced into Puerto Rico, and now occasionally planted along the streets, in gardens and "plazas."

Pithecellobium

USES: The hard and heavy, dark brown heart wood is strong and durable. It is used for general construction work, as fuel and for fence posts. The bark yields a high percentage of tannin and also a yellow dye. It is a satisfactory tree for hedges and also is excellent for planting on avenues.

COMMON NAMES: "Guamá americano," Madras thorn and Manila tamarind.

INSECT RECORDS**Insects Affecting the Leaves and Twigs****LEPIDOPTERA****Phoebis agarithe** (Boisduval)

(Pieridae) Caterpillar feeding on the foliage, reared by Mr. Cesáreo Pérez, at Río Piedras, (SIB:123).

HOMOPTERA**Icerya purchasii** Maskell

(Coccidae) On tree at the Agricultural Experiment Station, Río Piedras, (Wolcott, p. 134, 1941.)

Insects Affecting the Trunk**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) On tree, at San Sebastián Plaza (SIB:43), 1940. (GNW. & LFM.)

Pithecellobium unguis-cati (L.) Mart.

(Mimosaceae)

DISTRIBUTION: A shrub, rarely a small tree, growing in coastal thickets and on hillsides near the southern coast, extending north to the valley of the Coamo River, in Puerto Rico. Also recorded from Culebra, Vieques, Desecheo, Mona, Icacos, St. Croix, St. Thomas, St. Jan, Virgin Gorda, Anegada, Cuba, Jamaica, Hispaniola, Florida and northern South America.

COMMON NAMES: "Escambrón colorado," "Uña de gato," "Rolón," Crab prickles, Black-bead and Cat's claw.

Pithecellobium

INSECT RECORDS

Insects Affecting the Leaves.

LEPIDOPTERA

Acrocercops sp.

(Gracilariidae) Caterpillar a leaf-miner, very abundant at Salinas, altitude 100 ft., Feb. 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) *costalis* (Holmgren)

(Termitidae) Two small trees infested, with tunnels on their trunks, at Salinas, 100 ft. altitude, Sept. 13, 1940. (LFM.)

Kalotermes (K.) *snyderi* Light

(Kalotermitidae) At Mona Island. (Martorell, Jan. 1941, p. 81.)

Plumeria

**Plumeria alba* L.

(Apocynaceae)

DISTRIBUTION: A tree, growing in coastal thickets and on hillsides, at lower elevations in moist and dry districts of Puerto Rico. Also recorded from Muertos, Icacos, Culebra, Vieques, St. Thomas, St. Croix, St. Jan, Tortola, Virgin Gorda, Anegada, Anguilla to Grenada and Cayman Islands.

USES: The yellow wood is used in carpentry. It is hard, tough, heavy and strong. The juice is said to be poisonous and caustic, and is employed sometimes in the West Indies as a remedy for cutaneous and venereal diseases.

COMMON NAMES: "Tabaciba," "Tabaiba," "Alelf cimarrón," White paucipan, Nosegay tree, "Frangipanic blanc" and "Bois de lait" (Fr. West Indies).

**Note:* The correct generic name for this species is *Plumeria* L. in Sp. Pl. p. 209, 1753. It is often written incorrectly as *Plumiera* and *Plumieria*. (Writer's note.)

Plumeria**INSECT RECORDS****Insects Affecting the Leaves****LEPIDOPTERA****Pseudosphinx tetrio** (Linnaeus)

(Sphingidae) According to Dr. Möschler, the caterpillar of this species lives on *Plumeria*. (Möschler, p. 111.) Very abundant on trees, at Ballena, on the Guánica coast.

Isognathus rimosa (Grote) var. **wolcottii** Clark

(Sphingidae) According to Möschler, p. 110, the caterpillar of this species lives on *Plumeria*. The species of the host plant is not mentioned.

Plumeria obtusa L.

(Apocynaceae)

DISTRIBUTION: A glabrous, small tree, growing on the rocky soils of Mona Island, St. Croix (according to West), Bahamas, Cuba and Hispaniola.

COMMON NAMES: "Alelí cimarrón" and "Alelí de la Mona."

INSECT RECORDS**Insects Affecting the Leaves****LEPIDOPTERA****Pseudosphinx tetrio** (Linnaeus)

(Sphingidae) Very abundant, caterpillars feeding on the foliage of trees at Mona Island. (SIB:129), 1940 (LFM.). Also observed by Dr. Wolcott, very abundant and causing complete defoliation of trees at Mona, Sept. 13-15, 1944.

Plumeria rubra L.

(Apocynaceae)

DISTRIBUTION: A tree, commonly planted for ornamental purposes in Puerto Rico and the Virgin Islands, locally spontaneous after cultivation. A native of continental tropical America.

Plumeria

USES: No uses are attributed to this species in the Island, except for ornamental purposes.

COMMON NAMES: "Aleli," Red paucipan or "Frangipanic."

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA

Howardia biclavis (Comstock)

(Coccidae) Listed, (IB:134).

Insects Affecting the Leaves

LEPIDOPTERA

Pseudosphinx tetrio (Linnaeus)

(Sphingidae) According to Möschler, p. 111, the caterpillar of this species, lives on *Plumiera*. Mr. A. Busek, 1899, recorded this species on *P. rubra* L.

Isognathus rimosa (Grote) var. **wolcottii** Clark

(Sphingidae) According to Dr. Möschler, p. 110, the caterpillar of this species lives on *Plumiera*; not specifying on which of the species of the Genus.

Prosopis

Prosopis glandulosa Torrey

(Mimosaceae)

DISTRIBUTION: A tree, native to the southwestern sections of the United States and Mexico, introduced and planted at Guánica and San Germán. (In Britton and Wilson, Vol. 6, p. 539 as: *Neltuma glandulosa* (Torrey) Britton & Rose.)

USES: Planted for ornamental and shade purposes.

COMMON NAME: "Mesquite."

INSECT RECORDS

Insects Affecting the Leaves

Prosopis**LEPIDOPTERA****Melipotis ochrodes** (Guenée)

(Phalaenidae) Caterpillars in crevices under the bark of trees or under trash at the base, at Guánica. (IB:436) 1914. The caterpillar presumably feeding on the foliage at night.

Prosopis juliflora (Sw.) DC.

(Mimosaceae)

DISTRIBUTION: A tree, growing in thickets and on hillsides on the southern districts of Puerto Rico. Also recorded from St. Thomas, Tortola, Cuba, Hispaniola, Montserrat, Bonaire, Curacao, Aruba and continental tropical America. Introduced into the Bahamas and naturalized in the Philippines. (In Britton & Wilson, Vol. 6, p. 539 as: *Neltuma juliflora* (Sw.) DC.)

USES: Commonly planted in Puerto Rico and occasionally in the Virgin Islands, for ornament and for the use of its pods as food for cattle. The wood is valued for many purposes, such as railroad ties, carts, fence posts, fuel, charcoal, etc. The wood and bark are used for tanning. The gum exuded from the trunk is used in Mexico as a substitute for gum arabic and also when diluted in water is employed medicinally, as gargles for throat affections and in dysentery.

COMMON NAMES: "Mesquite," "Algarrobo del Hawaii" and "Bayahonda" (Puerto Rico), "Mezquite" and "Cuisache" (in some sections of Mexico), and "Aroma" in the Philippines.

INSECT RECORDS

Insects Affecting the Pods and Seeds

COLEOPTERA**Simicrips** sp.

(Monotomidae) Very small beetles, reared from infested seed pods, collected at Guánica Insular Forest, July 15, 1941. (LFM.)

Catorama neltumae Fisher

(Anobiidae) Seed pods, with a very intensive infestation, found in all stages inside mature, nearly dry pods, breeding abundantly, collected at Guánica Insular Forest, Dec. 5, 1940. (LFM.) (det: Fisher).

Prosopis**Acanthoscelides dominicanus** (Jekel)

(Bruchidae) Seeds pods infested by the larvae and adults of this species, as abundant in the pods, as the species of anobiid mentioned above, Guánica Insular Forest, Dec. 5, 1940. (det: Bridwell as: "prob. *dominicanus*.") (LFM.)

Amblycerus martorelli Bridwell

A fairly large bruchid beetle, destroying seed pods, as abundant as the two named species above, collected at the Guánica Insular Forest, Dec. 5, 1940. (det: Bridwell.) (LFM.)

LEPIDOPTERA**Corcyra cephalonica** (Stainton)

(Galleridae) Reared from pods of trees, collected at the Guánica Insular Forest, Dec. 5, 1940. Many moths reared from caterpillars feeding in the seeds of host trees. (LFM.)

HYMENOPTERA**Horismenus** sp.

(Entedontidae) Reared from pods, presumably a parasite of one of the larvae feeding on the pods of seeds, (IB:523), 1914.

Insects Affecting the Leaves

LEPIDOPTERA**Melipotis ochrodes** (Guenée)

(Phalaenidae) Caterpillars in crevices under bark of trees and also under trash at base, at Guánica, (IB:436) 1914. Presumably they feed on the foliage at night.

Paratorna rotundipennis (Walsingham)

(Tortricidae) Numerous caterpillars, tying the leaves together and almost defoliating a small tree, at Boquerón (IB:481), 1923.

Insects Affecting the Twigs

HOMOPTERA**Icerya purchasii** Maskell

(Coccidae) Slight infestation on the lower branches of a tree, in front of the Ranger's Cabin, at Camp Borinquen, Guánica Insular Forest, Sept. 17, 1941, altitude 300 ft., Guánica. (LFM.)

Prosopis

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Tunnels on the trunk of trees, at Guánica, June 1941 and 1942.

COLEOPTERA**Heterarthron gonogram** (Fabricius)

(Bostrychidae) At Guánica, listed (IB:244), 1913. Presumably boring in trunk or branches.

Euryscelis suturalis (Olivier)

(Cerambycidae) From logs, at Guayama, listed in (IB:262), 1925.

Psidium*Psidium guajava* L.

(Myrtaceae)

DISTRIBUTION: A shrub or a small tree, growing in thickets and on hill-sides, at lower and middle elevations in Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Florida, Bermuda, Cuba, Jamaica, Hispaniola and continental tropical America.

USES: The tree is widely planted for its fruit in tropical and subtropical countries. The hard brownish, strong and tough wood has a specific gravity of about 0.7, and is used for making agricultural implements, for posts, fuel and charcoal.

COMMON NAMES: "Guayaba," "Guayava," "Guayaba pera" and Guava.

INSECT RECORDS

Insects Affecting the Fruits

HEMIPTERA**Leptoglossus gonagra** (Fabricius)

(Coreidae) Adults and nymphs feeding on fruits, at Mayagüez, Arecibo and Peñuelas, (IB:169).

Psidium

COLEOPTERA

Lechriops psidii Marshall

(Curculionidae) Apparently a serious pest of the fruits, reared from them at Mayagüez, Bayamón, Aibonito and Arecibo, (IB:308).

Stephanoderes brazilensis Hopkins

(Scolytidae) From dry fruit at Corozal (IB:317).

Stephanoderes buscki Hopkins

In fruits, at Peñuelas, (IB:317).

Stephanoderes georgiae Hopkins

In fruits, at Peñuelas, (IB:317).

Xyleborus sacchari Hopkins

(Scolytidae) From fruits, at Cabo Rojo, (IB:319).

DIPTERA

Lydella incompleta Curran

(Larvaevoridae) Reared from fruits at Bayamón, (IB:353).

Chaetopsis fulvifrons Macquart

(Otitidae) Reared from fruit, at Naguabo, (SIB:118).

Anastrepha mombinpraeoptans Sein

(Tephritidae) One of the most important pests of the fruits; infesting guavas in all sections of Puerto Rico. (IB:377-88) and (SIB:119). Numerous records and localities cited.

Anastrepha unipuncta Sein

(Tephritidae) The second important fruit fly species which infests the fruits, causing considerable damages, in almost all localities of the island where the guava trees grow. Many localities recorded in (IB:378) and (SIB:119-20).

Psidium

HYMENOPTERA

Leptomastix dactylopii Howard

(Encyrtidae) Pupa in fruit, (IB:529). Presumably a fruit fly parasite.
Insects Affecting the Leaves

NEUROPTERA

Chrysopa collaris Schneider

(Chrysopidae) The larvae of this predaceous insect, is recorded, as feeding on scale insects, (*Croplastes* sp., on guava, (IB:62).

THYSANOPTERA

Selenothrips rubrocinctus (Giard)

(Thripidae) At Mayagüez, (IB:65), 1932. Presumably infesting the foliage.

HOMOPTERA

Aphis gossypii Glover

(Aphiidae) Listed (IB:113), 1923.

COCCIDAE

Icerya montserratensis Riley & Howard

At Lares, listed (IB:120).

Pseudococcus nipae (Maskell)

At Bayamón, Pueblo Viejo, Vega Baja, Lares and San Sebastián, (IB:126). A very common pest of guavas, affecting the foliage and sometimes the fruits.

Pulvinaria psidii Maskell

At Luquillo, Lares and Villalba, (IB:129).

Ceroplastes floridensis Comstock

Listed (IB:130).

Vinsonia stellifera (Westwood)

At Mayagüez, (IB:130).

Coccus viridis (Green)

At Pueblo Viejo, Guánica, Vega Baja and Arecibo, (IB:131).

Saissetia hemisphaerica (Targioni)

At Luquillo, listed (IB:132).

Psidium**Saissetia oleae** (Bernard)

At San Germán (SIB:59).

Aspidiotus destructor Signoret

At Bayamón (IB:138) and (SIB:61).

Chrysomphalus dictyospermi (Morgan)

Listed (IB:140).

Lepidosaphes gloverii (Packard)

Listed (IB:142).

(Aleyrodidae)

Aleurodicus minimus Quaintance

The most common white fly of guava, originally described from guava as a host tree, at Arecibo, Manatí and Mayagüez, (IB:145).

Aleurothrixus floccosus (Maskell)

Another common species of white fly on guava foliage (IB:146).

HEMIPTERA

Leptoglossus stigma (Herbst)

(Coreidae) On guava at Trujillo Alto, (IB:170). At Sabana Grande, (SIB:75). Mr. Barber says, "apparently the chief-food plant is guava."

COLEOPTERA

Scymnillus varipennis Sicard

(Coccinellidae) On leaves infested with white flies *Aleurodicus minimus* Quaintance and mealybugs, *Pseudococcus nipae* (Maskell), (IB:230).

Phyllophaga citri (Smyth)

(Scarabaeidae) Feeding on the foliage, recorded by Mr. E. G. Smyth, (IB:250).

Phyllophaga guanicana (Smyth)

Adults from February to July, with a maximum abundance in late April, feeding among other trees, on guava, (IB:251). (E. G. Smyth).

Cryptocephalus nigrocinctus Suffrian

(Chrysomelidae) At Juncos, listed (IB:267), 1916. Possibly feeding on the leaves.

Psidium

Longitarsus varicornis Suffrian

(Chrysomelidae) Adults abundant on the foliage of trees at Aguada,

(SIB:101), 1937. Undoubtedly the adults were feeding on the foliage (Martorell).

Attelabus sexmaculatus Chevrolat

(Curculionidae) The guava leaf-roller beetle, one of the most common pests of the tree, recorded from many localities of Puerto Rico, at low and middle elevations, (IB:290) and (SIB:102). (LFM.)

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Feeding on the foliage at Barceloneta, Villalba and San Sebastián (IB:298).

LEPIDOPTERA

Eupseudosoma involuta (Scpp)

(Arctiidae) According to Dr. Möschler, p. 114, the caterpillar of this species lives in *Psidium*. Later it has been confirmed and the caterpillar has been found feeding on guava, at Mayagüez, Lares, Caguas, (IB:415).

Ecpantheria icasia (Cramer)

(Arctiidae) Egg cluster on tree, from which 2,450 caterpillars hatched, (IB:417), 1917.

Olethreutes sp. (Olethreutidae)

Reared from guava at Corozal, (IB:481).

Strepsicrates smithianus (Walker)

(Olethreutidae) Reared from host tree, collected at El Yunque, by Dr. W. M. T. Forbes, (IB:482).

Megalopyge krugii (Dewitz)

(Megalopygidae) On foliage, parasitized by *Brachymeria robustella* (Wolecott), (IB:505). At Yabucoa, infesting trees, once in a while. (LFM.)

HYMENOPTERA

Solenopsis geminata (Fabricius)

(Formicidae) Attending *Pseudococcus nipae* (Maskell) on trees at Lares, (IB:545), 1912.

Psidium

Insects Affecting the Twigs

HOMOPTERA

(Membracidae)

Nessorhinus gibberulus Stål

Listed (IB:73), 1916.

(Cercopidae)

Philaenus fusco-varius Stål

At Bayamón, Cidra and Ponce, (IB:75).

(Fulgoridae)

Neurotmeta sponsa Guérin

At Aibonito (IB:97).

Neocolpoptera monticolens Dozier

At Bayamón, (IB:101).

Ormenis infuscata Stål

At Arecibo, (IB:102).

Punana puertoricensis Muir

At Aibonito, (IB:106).

Psychotria

Psychotria berteriana DC.

(Rubiaceae)

DISTRIBUTION: A tree, growing in forests, ravines and thickets at middle and higher elevations in wet or moist districts of Puerto Rico. Also recorded from Cuba, Jamaica, Hispaniola, St. Kitts, from Montserrat to Trinidad and Colombia.

COMMON NAME: "Palo moro."

Psychotria

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA**Saissetia hemisphaerica** (Targioni)

(Coccidae) Twigs of tree, infested by scale insects, at Cerro de Punta, Jayuya, altitude 3,300 ft., Jan. 26, 1941. (LFM.)

Pterocarpus*Pterocarpus indicus* Willd.

(Fabaceae)

DISTRIBUTION: A tree, native to tropical Asia, introduced and planted at the U. S. Forest Service grounds at Río Piedras.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Tunnels on trunk of a large tree, at Río Piedras, Dec. 4, 1940. (LFM.)

Pterocarpus officinalis Jacq.

(Fabaceae)

DISTRIBUTION: A large tree, growing in the forests, at lower and middle elevations, in Puerto Rico. Also recorded from Guadeloupe, Dominica, St. Lucia, St. Vincent, Trinidad and continental tropical America.

USES: The light brown wood is weak and not durable; has a specific gravity of about 0.6, and is used for fuel.

Pterocarpus

COMMON NAMES: "Palo de pollo," "Palo pollo," "Sangre de drago" and Swamp blood wood.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Ischnaspis longirostris (Signoret)

(Coccidae) At Mayagüez, listed (IB:143). Host tree, listed as *Pterocarpus draco* = *P. officinalis* Jacq.

Quararibaea

Quararibaea turbinata (Sw.) Poir

(Bombacaceae)

DISTRIBUTION: A tree, growing in forests and wooded hills at lower and middle elevations, in wet or moist districts of Puerto Rico. Also recorded from St. Jan, St. Croix, Hispaniola, from St. Eustatius to Grenada^u and continental tropical America.

COMMON NAMES: "Garrocho," "Garrocha," "Palo de garrocha" and Swizzle-stick tree.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Large tree, infested with termites, at Guajataca, Nov. 17, 1940. (LFM.)

Randia*Randia aculeata* L.

(Rubiaceae)

DISTRIBUTION: A shrub or small tree, growing in thickets and on hill-sides, at lower and middle elevations, mostly in dry districts of Puerto Rico. Also recorded from Icacos, Mona, Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Anegada, Florida, Bermuda, Cuba, Jamaica, Hispaniola, Trinidad and Curacao. (In Britton & Wilson, Vol. 6, p. 231 as: *Randia mitis* L.)

USES: The brown, hard, strong, heavy and durable wood is not locally used. The green fruit is astringent and in the West Indies it has been employed as a remedy for dysentery.

COMMON NAMES: "Escambrón," "Tintillo," "Palo de cotorra," Box brier, Dogwood, Christmas tree and Ink berry.

INSECT RECORDS

Insects Affecting the Fruits

HYMENOPTERA**Prodecatoma** sp.

(Chalcididae) Many minute wasps, reared from the fruits of trees, the larvae of which destroyed a very large percentage of the seeds. Collected at Aibonito, Aug. 20, 1941. (J. I. Otero) (LFM.)

Insects Affecting the Leaves

COLEOPTERA**Pachybrachys mendicus** Weise

(Chrysomelidae) At Ponce, listed (IB:266), possibly feeding on the foliage.

Oiketicus kirbyi Guilding

(Psychidae) Several bags containing live caterpillars on twigs, at Cabo Mala Pascua, Maunabo, Nov. 16, 1943. (GNW.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Large tree, infested by termites, at Guajataca, Nov. 24, 1940. Many tunnels on the trunk. (LFM.)

Rapanea*Rapanea ferruginea* (R. & P.) Mez

(Myrsinaceae)

DISTRIBUTION: A tree, growing in forests, thickets, along forest borders and in wooded hills, in wet or moist districts of Puerto Rico ascending to higher elevations. Also recorded from Jamaica, Cuba, Hispaniola, from Saba to Grenada and continental tropical America.

COMMON NAMES: "Arrayán," "Cucubano," "Mameyuelo" and "Mantequero."

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Toxoptera aurantii (Fonsecolombe)

(Aphiidae) On leaves and young shoots of tree, at Maricao Insular Forest, 1,300 ft. altitude (SIB:55), 1940. Also at Aguas Buenas, very abundant on the foliage and twigs, altitude 1,100 ft., June 2, 1940. (LFM.)

COLEOPTERA

(Curculionidae)

Lachnopus seinei Wolcott

(Curculionidae) On tender leaves, in mountains north of Yauco, (IB:302), Aug. 1923 (F. Seín). Also at Aibonito, (SIB:302), 1940.

Lachnopus yaucona Wolcott

On tender leaves of trees, in mountains north of Yauco, collected by Mr. F. Seín, Aug. 23, 1933, (IB:302).

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trunk of various trees, at Aguas Buenas, altitude 1,200 ft., June 2, 1940. (LFM.)

Rapanea

Rapanea guianensis Aubl.

(Myrsinaceae)

DISTRIBUTION: A shrub or a small tree, growing in thickets and woodlands, at lower elevations, in the northern and western districts of Puerto Rico. Recorded also from Tortola, Florida, Bahamas, Jamaica, Cuba, Hispaniola, Martinique, St. Vincent, Grenada, Trinidad and continental tropical America.

COMMON NAMES: "Bádula."

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA

(Coccidae)

Asterolecanium pustulans (Cockerell)

At Dorado, (SIB:57).

Ceroplastes floridensis Comstock

At Pueblo Viejo, (IB:130), 1915.

Rauwolfia

Rauwolfia nitida Jacq.

(Apocynaceae)

DISTRIBUTION: A tree, growing in thickets, woodlands and on hillsides, at lower and middle elevations in Puerto Rico. Recorded also from St. Croix, St. Thomas, St. Jan, Tortola, St. Barts, Bahamas, Jamaica, Cuba and Hispaniola. (In Britton & Wilson, Vol. 6, p. 90 as: *Rauwolfia tetraphylla* L.)

COMMON NAMES: "Cachimbo," "Palo amargo," "Muñeco," "Palo de muñeco" and Milk bush.

INSECT RECORDS

Insects Affecting the leaves and Twigs

ISOPTERA

Kalotermes (K.) snyderi Light

(Kalotermitidae) Infesting the dead branches of live trees. Mona Island, April 5, 1944. (GNW. & LFM.)

HOMOPTERA

(Coccidae)

Asterolecanium pustulans (Cockerell)

Infestation on twigs and branches, killing many, few trees infested, at Guayama, Nov. 20, 1940, altitude 50 ft. (LFM.)

Pulvinaria psidii Maskell

At Ponce and Guánica, (IB:128-9).

Ceroplastes cirripediformis Comstock

Heavy infestation of a small tree, killing some branches, other trees in the vicinity also affected, at Guayama, altitude 50 ft., Nov. 24, 1940. (LFM.)

Coccus viridis (Green)

Abundant on trees, at Aguadilla, on the undersides of leaves and on twigs, 1938. (LFM.) Abundant on young shoots of trees at Sardinera Beach, Mona Island, April 4, 1944. Attacked by fire ants, *Solenopsis geminata* Fabr. (LFM.)

Saissetia hemisphaerica (Targioni)

At Ponce, listed (IB:132), 1913.

COLEOPTERA

Cryptolaemus montrouzeri Mulsant

(Coccinellidae) Feeding on *Pulvinaria psidii* Maskell, on host tree, at Guánica, (IB:229), 1921. On trees infested with scale insect, *Coccus viridis* (Green) at Aguadilla, (SIB:92), 1938.

Cycloneda sanguinea Linnaeus

(Coccinellidae) Adults abundant on twigs and foliage, at Guayama, altitude, 40 ft., Nov. 14, 1940. Possibly feeding on the scale insects infesting the tree.

Rauwolfia**Metachroma antennalis** Weise

(Chrysomelidae) On leaves of tree, near Faro de Agujerada, Aguadilla, (IB:270), 1931. Possibly feeding on the foliage.

LEPIDOPTERA**Diaphania costata** (Fabricius)

(Pyraustidae) Caterpillar a leaf-folder, at Camuy, (IB:462), 1922. Listed as *Margaronia aurocostalis* Guenée. Found at Guajataca, caterpillars folding leaves Nov. 17, 1940 (LFM. & L. E. Gregory) and later at Guayama, very abundant and attacking many trees in the vicinity, Nov. 24, 1940. (LFM.) Many trees infested at Sardinera Beach, Mona Island, April 4, 1944. (LFM.)

HYMENOPTERA**Brachygaster pygmaeus** Fabricius

(Evaniiidae) These minute, queer looking evaniids, were very abundant on the leaves of trees, at Guayama, apparently looking for some host to parasitize, Nov. 14, 1940. (det: Cushman) (LFM.).

Tiphia sp.

(Tiphidae) Three males collected by Mr. E. H. Barrows, feeding on secretions of the scale insect, *Pulvinaria psidii* Maskell, at Guánica, (IB:563), 1921.

Myzine haemorrhoidalis (Fabricius)

(Scoliidae) Feeding on the excrement of the green scale, *Coccus viridis* (Green) on trees, at Aguadilla, (SIB:153), 1938. (LFM.)

Rhizophora*Rhizophora mangle* L.

(Rhizophoraceae)

DISTRIBUTION: A shrub or tree, growing in the coastal swamps of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Anegada, Florida, Bermuda, Cuba, Jamaica, Hispaniola, continental tropical America and tropical Africa.

Rhizophora

USES: The hard and strong brown wood, valued for piling posts and in boat building, has a specific gravity of 1.16. The bark of the tree is used in tanning, for its high content of tannic acid.

COMMON NAMES: "Mangle," "Mangle colorado," "Mangle sapatero," Mangrove or Red mangrove.

INSECT RECORDS

Insects Affecting the Fruits

COLEOPTERA

Anthonomus sp.

(Curculionidae) In seeds, at Ponce, (IB:305).

Stephanoderes sp. near **brunneus** Hopkins

(Scolytidae) In seed balls, at Ponce (IB:317).

Insects Affecting the Leaves

COLEOPTERA

(Chrysomelidae)

Pachybrachys sp.

At Ponce, listed (IB:266).

Cryptocephalus nigrocinctus Suffrian

At Mayagüez, (IB:267), 1923.

Homophoeta cyanipennis Fabricius

On foliage, at Laguna de San José, Río Piedras, listed (IB:276), 1923.

Altica jamaicensis (Fabricius)

A greenish specimen, at Laguna de San José, Río Piedras, (IB:278), 1923.

Chaetocnema apricaria Suffrian

Making brownish curved slits in the undersides of the leaves, at Mayagüez, and at Martín Peña, (IB:281) (GNW.). At El Pastillo, near Santa Isabel, many trees attacked by this species, thousands of the adults on the foliage. The characteristic curved slits on the leaves, tremendously abundant, counting as many as 35 of them on a leaf, May 1942. (LFM.)

Rhizophora**LEPIDOPTERA****Megalopyge krugii** (Dewitz)

(Megalopygidae) At Martín Peña, (IB:505), 1923. Also cocoons very abundant on the trunk of many trees, at El Pastillo, near Santa Isabel, the caterpillars of which presumably fed upon the foliage before pupation. May 1942. (LFM.)

Insects Affecting the Twigs

HOMOPTERA**Clastoptera brevis** (Walker)

(Cercopidae) At Ponce, listed (IB:75).

Colpoptera carinata Dozier

(Fulgoridae) At Maní Beach, (IB:99), Aug. 11, 1935. (Dozier.)

COLEOPTERA**Lepturges guadeloupensis** Fleutiaux & Sallé

(Cerambycidae) A single adult collected near Loíza, on a dead twig, May 1940. (D. DeLeón.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Infesting trees at Camp Piñones, Santurce, Sept. 15, 1940. Also at El Pastillo, near Santa Isabel, observed, May-June 1942. (LFM.)

COLEOPTERA**Chrysobothris tranquebarica** (Gmelin)

(Buprestidae) A common insect on our mangrove swamps, larvae boring in trunk of trees; one of the most injurious pests of this tree species. (LFM.)

LEPIDOPTERA**Psychonoctua personalis** Grote

(Cossidae) Caterpillar boring in trunk, at Punta de Cangrejos (IB:484). Very injurious and quite pestiferous at times, boring in the trunk and larger branches of trees, weakening them so, that they are easily broken by the wind. (LFM.)

Roystonea

Roystonea borinquena Cook

(Arecaceae)

DISTRIBUTION: A palm, growing in forests and on hillsides, in wet or moist districts, as well as in the valleys of the southern sections of Puerto Rico. Also recorded from Vieques and St. Croix. Endemic.

USES: The leaves are used for thatching houses and barns and their broad bases for the sides of huts and other structures. It is much planted for ornament. The fruits are eaten by the pigs.

COMMON NAMES: "Palma real," "Palma de yaguas," "Yaguas," "Palma de costa" Royal palm and Cabbage palm.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

Ischnaspis longirostris (Signoret)

(Coccidae) Listed (IB:143). Possibly on the foliage.

COLEOPTERA

Phyllophaga vandinei (Smyth)

(Scarabaeidae) Adults feeding on the foliage, causing considerable damage, at Isabela, May 22, 1941. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on the trunk of many palms, on the hills west of Yabucoa, May 1942. (LFM.)

Sabinea

Sabinea florida (Vahl) DC.

(Fabaceae)

DISTRIBUTION: A small tree, growing in thickets, on banks and hillsides,

Sabinea

at lower and middle elevations in moist districts of Puerto Rico, Culebras, Vieques, St. Jan, St. Thomas, Tortola, Virgin Gorda. Endemic.

USES: Planted for ornamental purposes.

COMMON NAMES: "Retama" and Wattapama.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on tree, at Guajataca, Nov. 24, 1940. (LFM.)

Salix

Salix chilensis Molina

(Salicaceae)

DISTRIBUTION: A tree, growing in different sections of Puerto Rico, valleys and mountains, at low and high altitudes, widely propagated after its introduction. Also recorded from St. Croix, Jamaica, Cuba, Martinique, St. Vincent, Texas, Mexico and Central America. Native of S. America.

USES: Often planted for ornament, and also used as live fences.

COMMON NAMES: "Sauce" and Humboldt's willow.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

Asterolecanium pustulans (Cockerell)

(Coccidae) According to Dr. Dozier, this species is one of the worst pests of willows, (IB:122).

Pseudaulacaspis pentagona (Targioni)

(Coccidae) At Mayaguez, (IB:135), listed as *Aulacaspis pentagona* Targioni.

Salix

COLEOPTERA

Cryptocephalus nigrocinctus Suffrian

(Chrysomelidae) At Florida, between Barceloneta and Arecibo, (IB :267), 1921.

LEPIDOPTERA

Characoma nilotica Rogenhofer

(Phalaenidae) Caterpillar semi-transparent greenish white, feeding on buds and webbing together small leaves of tree, at Aguadilla, (IB :430), 1922.

Insects Affecting the Trunk

COLEOPTERA

Apate monachus Fabricius

(Bostrychidae) According to Mr. Van Zwaluwenburg, this species bores in the trunk of trees, (IB :243).

Samanea

Samanea saman (Jacq.) Merrill

(Mimosaceae)

DISTRIBUTION: A tree, growing along roadsides and on hillsides in Puerto Rico, naturalized after its introduction from continental tropical America. Also recorded from St. Thomas, St. Croix; widely naturalized in the West Indies. (In Britton & Wilson, Vol. 5, p. 349 as: *Samanea Saman* (Willd.) Merrill.)

USES: The tree is planted for shade; its pods furnish food for cattle. The reddish wood, is hard and heavy, but not durable.

COMMON NAMES: "Samán," "Guango," Rain tree, Giant thibet and Cow bean tree.

Samanea**INSECT RECORDS****Insects Affecting the Leaves****HOMOPTERA****Heteropsylla puertoricoensis** Caldwell

(Chermidae) Recorded as undetermined psyllids in (IB:111). The insect lives on the foliage of the tree, nothing is known about its biology, so far.

Icerya montserratensis Riley & Howard

(Coccidae) Listed (IB:119).

LEPIDOPTERA**Erebus odora** (Linnaeus)

(Phalaenidae) According to Dr. Möschler, p. 210, the caterpillar of this species lives on the foliage of this tree, listed (IB:434).

Insects Affecting the Twigs**HOMOPTERA****Proarna hilaris** (Germar)

(Cicadidae) Abundant on tree, at Salinas, many of them on twigs and smaller branches, singing morning and afternoon, (SIB:50), 1939. (LFM.)

Pinnaspis minor (Maskell)

(Coccidae) At Mayagüez, listed (IB:136).

Sapium

Sapium laurocerasum Desf.

(Euphorbiaceae)

DISTRIBUTION: A tree, growing in forests, and wooded hills in wet or moist districts of Puerto Rico, mostly at middle and higher elevations. Also recorded from St. Jan. Endemic.

Sapium

COMMON NAMES: "Lechesillo," "Lehecillo," "Hincha huevos," "Manzanillo," "Tabeiba" and Milk-tree.

INSECT RECORDS

Insects Affecting the Leaves

HEMIPTERA

Pachycoris fabricii (Linnaeus)

(Scutelleridae) Adults and nymphs on leaves, of trees, apparently breeding, at Río Abajo Plantations, Utuado, altitude 1200 ft., April 20, 1941. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trunk of tree, at Luquillo, 1941 and at Río Abajo Plantations, Utuado, April 20, 1941. (LFM.)

Sciacassia

Sciacassia siamea (Lam.) Britton

(Caesalpiniaceae)

DISTRIBUTION: A tree, native to southern Asia, introduced and planted along roadsides, gardens and farms, in Puerto Rico.

USES: The dark brown and streaked heartwood is used for making small ornamental articles. The wood can be used for fuel as well as charcoal. It has been also planted for shade and ornament.

COMMON NAMES: "Cassia amarilla," "Cassia siamea" and Bombay blackwood.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Megalopyge krugii (Dewitz)

(Megalopygidae) Many cocoons attached to the trunk of trees, the

Sciacassia

caterpillars presumably fed on the foliage; at San Lorenzo, 500 to 800 ft. in altitude, Aug. 25, 1940 and April 6, 1941. (LFM.)

Insects Affecting the Twigs and Branches**HOMOPTERA*****Asterolecanium pustulans* (Cockerell)**

(Coccidae) The worst pest of this tree species, killing many of them in certain sections of the Island. The scale insect affects the twigs, branches and even the trunk. (IB:122), 1934, and (SIB:57), 1937. Killing trees at San Lorenzo, on the Patillas road, altitude 500 to 900 ft. Aug. 25, 1940 to April 4, 1941. (LFM.)

***Saissetia oleae* (Bernard)**

(Coccidae) Slight infestation, on trees heavily infested by *Asterolecanium pustulans* (Cockerell), at San Lorenzo, 800 ft. high, April 6, 1941.

Insects Affecting the Trunk**ISOPTERA*****Nasutitermes* (N.) *costalis* (Holmgren)**

(Termitidae) Trees at Cayey Nurseries, about 5 or 6 years old with tunnels on their trunks, May 1942. (LFM.)

HOMOPTERA***Asterolecanium pustulans* (Cockerell)**

(Coccidae) Trees with trunks fully covered by the scales at Toa Baja, Cayey, and San Lorenzo, April 1941. (LFM.)

Sideroxylon***Sideroxylon foetidissimum* Jacq.**

(Sapotaceae)

DISTRIBUTION: A tree, growing in woodlands, river valleys and on hill-sides at lower elevations in dry and moist districts of Puerto Rico. Also

Sideroxylon

recorded from St. Croix, St. Thomas, St. Jan, Florida, Bahamas, Jamaica, Cuba, Hispaniola and from Saba to Barbados.

USES: Its reddish or yellow wood is hard, very strong and durable, with a specific gravity a little over 1.00. No uses are attributed so far, to this species in our Island. In British Honduras the trees of the same genus, are said to be suitable for flooring and heavy construction.

COMMON NAMES: "Tortugo amarillo," "Tortugo," "Tortugo prieto," "Caguani" (Cuba) and Mastic (Florida).

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA*****Ceropsylla sideroxyli* Riley**

(Chermidae) A pit forming psyllid on leaves of host trees at Ciales, 1936 and Mona Island, 1940, (SIB:54). Very heavy infestation of leaves, causing defoliation, at Camuy, Feb. 5, 1941; also very abundant at Manatí, Sept. 10, 1940. (GNW. & LFM.)

***Saissetia hemisphaerica* (Targioni)**

(Coccidae) Slight infestation. Camp Kofresi, Mona Island, Sept. 1944, (GNW.). Det: H. Morrison.

***Coccus viridis* (Green)**

(Coccidae) Slight infestation. Camp Kofresi, Mona Island, Sept. 1944, (GNW.). Det: H. Morrison.

***Eucalymnatus tessellatus* (Signoret)**

(Coccidae) Slight infestation. Camp Kofresi, Mona Island, Sept. 1944, (GNW.). Det: H. Morrison.

Insects Affecting the Twigs**HOMOPTERA*****Saissetia oleae* (Bernard)**

(Coccidae) Fairly abundant on the twigs, some of them also on the undersides of leaves, at Guánica, (SIB:60), 1940.

HYMENOPTERA***Camponotus ustus* Forel**

(Formicidae) Large ants, winged and wingless forms, boring in twigs of trees and breeding abundantly; pupae by the hundreds inside the

Sideroxylon

bores in twigs and smaller branches, at Guajataca Gorge, near Quebradillas, Nov. 17, 1940, altitude 30 ft. (LFM.)

Insects Affecting the Trunk**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Dead nest on trunk of large tree, about 40 ft. high and 20 inches in diameter, at Salinas, altitude 150 ft., Oct. 1940. Nest and tunnels on trees, at Maunabo, Feb. 1941, Guajataca and on the Vigia-Islote road, near Arecibo, 1942, all at low elevations. (LFM.)

HYMENOPTERA**Camponotus ustus** Forel

(Formicidae) Ants breeding under the bark of tree, at Ciales, (SIB:150), 1940. (GNW. & LFM.)

Sloanea*Sloanea berteriana* Choisy

(Elaeocarpaceae)

DISTRIBUTION: A tree, growing in the forests, at middle or higher elevations, in moist or wet districts of Puerto Rico. Also recorded from Hispaniola and Guadeloupe.

USES: The nearly white wood, is heavy, strong and durable and is employed in general construction work. It is also used for fuel and charcoal.

COMMON NAMES: "Cacao motillo," "Cacao roseta," "Cacao," "Motillo," "Cacaillo," "Cacaotillo" and "Roseta."

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA****Pseudococcus nipae** (Maskell)

(Coccidae) Scales or coccids abundant on the undersides of leaves, at Camp Guavate, Cayey, May 17, 1940. (LFM.)

Spathodea

Spathodea campanulata Beauv.

(Bignoniaceae)

DISTRIBUTION: A tree, native to tropical Asia, occasionally planted for ornament and shade in Puerto Rico and the Virgin Islands.

COMMON NAMES: "Tulipán africano," African tulip tree and *Spathodea*.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Saissetia hemisphaerica (Targioni)

Slight infestation on the lower branches, affecting the twigs and leaves, on a tree at Manatí, Aug. 30, 1940. (LFM.)

Saissetia oleae (Bernard)

Listed (IB:133). Slight infestation on branches and twigs of a young tree, at Aibonito, Oct. 13, 1940, altitude 2,300 ft. (LFM.)

LEPIDOPTERA

Eulepte concordalis Hübner

(Pyraustidae) Caterpillars feeding on the foliage of trees, and webbing leaves together, at Aibonito, Oct. 13, 1940, altitude 2,300 ft. (LFM.)

Laetilia portoricensis Dyar

(Phycitidae) Caterpillars feeding on scale insects, *Saissetia oleae* (Bernard) on tree, listed (IB:479).

Hyblaea puera (Cramer)

(Hyblaeidae) Caterpillars feeding on the foliage, at Lares, 1924 and La Florida, between Barceloneta and Arecibo, 1932, (IB:479).

Insects Affecting the Twigs

HYMENOPTERA

Myrmelachista ramulorum Wheeler

(Formicidae) On trees, at El Consumo and Maricao, (IB:555), 1935. Listed as *M. ambigua* Forel *ramulorum* Wheeler.

Spondias*Spondias cirouella* Tussac

(Anacardiaceae)

DISTRIBUTION: A tree, growing in farms, on hillsides and along roadsides in Puerto Rico and the Virgin Islands.

USES: Planted for its fruit and for shade. It is also used as live fence in farms, especially in the southern coast of Puerto Rico.

COMMON NAME: "Ciruela."

INSECT RECORDS

Insects Affecting the Fruits

DIPTERA

Anastrepha mombinpraeoptans Seín

(Tephritidae) Reared from fruits at Río Piedras, (IB:376), also at Arecibo, (SIB:119).

Insects Affecting the Twigs

HOMOPTERA

Saissetia hemisphaerica (Targioni)

(Coccidae) Very heavy infestation on twigs and branches, on a small tree, many twigs killed on account of the attack, at Guayanilla, Dec. 4, 1940. (LFM.)

Insects Affecting the Trunk

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Listed by Martorell (Jan. 1941, p. 81).

Spondias dulcis Forst

(Anacardiaceae)

DISTRIBUTION: A tree, native to the Pacific Islands, introduced into Puerto Rico, planted in gardens and farms.

USES: The tree is planted for its edible fruit; the wood used for fuel.

COMMON NAMES: "Cítara," and "Jobo de la India."

Spondias

INSECT RECORDS

Insects Affecting the Fruits

DIPTERA

Anastrepha mombinpraeoptans Seín

(Tephritidae) Reared from fruits at Río Piedras, (IB:376).

Anastrepha unipuncta Seín

Reared from fruits, (SIB:119).

Insects Affecting the Leaves and Twigs

HOMOPTERA

Saissetia oleae (Bernard)

(Coccidac) At Ponce, (IB:133).

Aleurothrixus floccosus (Maskell)

(Aleyrodidae) At Ponce, (IB:146).

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest and tunnels on large trees, at Lares, on the San Sebastián road, altitude 1,270 ft., Dec. 10, 1941. (LFM.)

Spondias mombin L.

(Anacardiaceae)

DISTRIBUTION: A tree, growing in woodlands, river valleys, on hillsides and along roadsides, at lower and middle elevations, in Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Tortola, Cuba, Jamaica, Hispaniola, continental tropical America and the Old World tropics.

USES: The tree is planted for shade along roadsides and for its edible fruit in farms and gardens. The wood is strong, light brown, durable, with a specific gravity of about 0.5. It has very little use locally, except

Spondias

for fuel. In some parts of the world, it is employed in the interior decoration of houses, in Brazil it has been used for paper pulp.

COMMON NAMES: "Jobo," "Jobo de perro," "Jobo vano" and Hog-plum.

INSECT RECORDS**Insects Affecting the Fruits****DIPTERA****Anastrepha mombinpraeoptans** Seín

(Tephritidae) Reared from fruits, at Río Piedras, (IB:376). Also at Arecibo, (SIB:119).

HYMENOPTERA**Opius anastrephae** Viereck

(Braconidae) Attacking the larvae of *Anastrepha fraterculus* Wied. = *A. mombinpraeoptans* Seín in fruits of *Spondias lutea* = *S. mombin* L., listed (IB:509).

Ganaspis hookeri Crawford

(Figitidae) Attacking the larvae of *Anastrepha fraterculus* Wied. = *A. mombinpraeoptans* Seín, in fruits of *S. lutea* = *S. mombin* L., (IB:518).

Insects Affecting the Leaves**THYSANOPTERA****Selenothrips rubrocinctus** (Giard)

(Thripidae) On leaves of tree, (IB:65), 1912. Large tree with foliage heavily infested by thrips, at Guajataca, Oct. 24, 1940. Abundant on trees, at Yabucoa, causing chlorosis of leaves, Feb. 1941. (GNW. & LFM.)

HEMIPTERA**Empicoris rubromaculata** (Blackburn)

(Reduviidae) Feeding on thrips on the foliage of tree, (IB:160), 1916. The host is presumably, *Selenothrips rubrocinctus* (Giard).

COLEOPTERA**Diabrotica graminea** Baly

(Chrysomelidae) On leaves of tree, (IB:272). Possibly feeding on the foliage.

Spondias

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Feeding on the foliage, at Luquillo, Fajardo, Yabucoa, Santa Isabel, Arecibo, Manatí and Ponce, (IB:298). Eggs between the leaves of tree, at Ponce, (IB:299). Adults feeding on the foliage of tree, at Caguas, Dec. 24, 1940, altitude 850 ft., on the Caguas-Cayey road. (LFM.)

LEPIDOPTERA

Archips jamaicana (Walker)

(Tortricidae) Caterpillar on tree, (IB:480). Presumably on the foliage.

Insects Affecting the Twigs

HOMOPTERA

Nessorhinus gibberulus Stål

(Membracidae) Listed (IB:73), 1916.

Monobelus fasciatus (Fabricius)

(Membracidae) Listed (IB:74), 1916.

Pulvinaria psidii Maskell

(Coccidae) At Arroyo, (IB:128), 1912.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) At Mayagüez, listed (IB:49), 1921. Trees at Yabucoa, Cayey and Ponce, infested with nests and tunnels on the trunk and branches. A very common pest of this tree, May 1942. (LFM.)

Spondias purpurea L.

(Anacardiaceae)

DISTRIBUTION: A tree, growing on hillsides and along roadsides in Puerto Rico. Also recorded from St. Croix, St. Thomas, St. Jan, Jamaica,

Spondias

Cuba, Hispaniola, Cayman Islands, St. Martin to Trinidad and continental tropical America.

USES: The tree is planted for its fruit and shade and as live fences. The wood is used for fuel.

COMMON NAMES: "Jobillo," "Jobo francés," "Ciruela del país," Spanish plum and Jamaica plum.

INSECT RECORDS**Insects Affecting the Fruits****DIPTERA****Anastrepha mombinpraeoptans** Seán

(Tephritidae) Reared from fruits at Río Piedras, (IB:376).

Insects Affecting the Leaves and Twigs**HOMOPTERA****Pseudischnaspis bowreyi** (Cockerell)

(Coccidae) Listed (SIB:62).

LEPIDOPTERA**Megalopyge krugii** (Dewitz)

(Megalopygidae) Cocoons abundant on trunk of trees, at Ponce, the caterpillar presumably feeding on the foliage, 1940. (LFM.)

HYMENOPTERA**Myrmelachista ramulorum** Wheeler

(Formicidae) Trees infested by this ant, boring into the twigs and breeding there; all stages found in bores, Lares, Dec. 10, 1941, altitude 1,270 ft. (LFM.)

Stahlia

Stahlia monosperma (Tul.) Urban

(Cacsalpiniaceae)

DISTRIBUTION: A tree, growing in the coastal woodlands, at the eastern and southern districts of Puerto Rico; also recorded from Vieques. Endemic.

Stahlia

USES: The nearly black wood is hard, heavy and strong and is much valued for furniture. The tree has become very scarce.

COMMON NAMES: "Cóbana," "Cóbano," "Cóbana negra" and "Polisandro."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

***Aspidiotus lataniae* Signoret**

(Coccidae) Heavy infestation on branches, twigs and leaves of an old tree, at Guánica, attended by fire ants, *Solenopsis geminata* (Fabricius), Jan. 5, 1941. (det: Morrison) (LFM.).

HYMENOPTERA

***Solenopsis geminata* (Fabricius)**

(Formicidae) Abundant, attending coccids, *Aspidiotus lataniae* Signoret, on tree, at Guánica, Jan. 5, 1941. (LFM.)

Insects Affecting the Trunk

COLEOPTERA

***Chlorida festiva* (Linnaeus)**

(Cerambycidae) Larvae tunneling logs of trees, at Nagualbo, (IB:259), 1926.

Sterculia

Sterculia apetala (Jacq.) Karst.

(Sterculiaceae)

DISTRIBUTION: A tree, native to northern South America, introduced into Puerto Rico and planted in several sections of the island, most abundant on the dry southern coast.

USES: Locally planted for shade and ornament. The wood is used for fuel, in the southern coast of the island, where the tree is very common along roadsides, especially near Ponce, on the Ponce-Santa Isabel road.

Sterculia

In Mexico, parts of the tree are employed for catarrhal and pectoral affections.

COMMON NAMES: "Anacagüitas" and Panama tree.

INSECT RECORDS**Insects Affecting the Leaves****HOMOPTERA****(Coccidae)*****Pseudococcus nipae* (Maskell)**

At Salinas (IB:127), 1935. Also at Guánica, (SIB:58), 1940. Trees with the undersides of the foliage heavily infested by this coccid, near Ponce, on the Juana Díaz road. The coccids were kept under control by means of ladybird beetles. June 1941. (LFM.)

***Saissetia oleae* (Bernard)**

Abundant on leaves and also twigs of trees, near Ponce, Sept. 19, 1940. (LFM.)

COLEOPTERA***Hyperaspis connectens* Thunber**

(Coccinellidae) Abundant on the undersides of leaves, infested by *Pseudococcus nipae* (Maskell), at Ponce, June 1941. (LFM.)

***Scymnillus nunenmacheri* Sicard**

(Coccinellidae) Abundant, feeding on the undersides of leaves infested by *Pseudococcus nipae* (Maskell), at Ponce, June 1941. (LFM.)

***Phyllophaga vandinei* (Smyth)**

(Scarabaeidae) Adults feeding on the foliage of trees, at Isabela, May 22, 1941. (LFM.)

Insects Affecting the Trunk**ISOPTERA*****Nasutitermes* (N.) *costalis* (Holmgren)**

(Termitidae) Tunnels on the trunks of large trees, at Salinas, April 6, 1941. Many trees infested near Ponce, on the Santa Isabel road, May 1942. (LFM.)

Swietenia*Swietenia macrophylla* King

(Meliaceae)

DISTRIBUTION: A tree, native to the forest regions from Mexico to Colombia, introduced into Puerto Rico, for reforestation purposes.

USES: In British Honduras, the wood is used for boat building, dugout canoes and interior trim. It has been suggested to be used for airplane propellers, speed boat hulls, cabinet work and furniture.

COMMON NAMES: "Caoba," "Caoba de Honduras," Mahogany and Honduras mahogany.

INSECT RECORDS

Insects Affecting the Seeds

COLEOPTERA

Carpophilus dimidiatus var. **mutilatus** Erichson

(Nitidulidae) All stages found in bags of imported seeds, at the Cayey Nurseries, (SIB:89), 1937. Many of the seed was destroyed by the larvae of this insect. (LFM.)

Insects Affecting the Leaves

HOMOPTERA

Ischnaspis longirostris (Signoret)

(Coccidae) On trees, at Río Grande, very heavy infestation, especially on the undersides of the leaves, causing many of the leaves to turn yellowish, (SIB:63), 1940. (LFM.)

COLEOPTERA

Phyllophaga vandinei (Smyth)

(Scarabaeidae) Adults feeding on the foliage doing considerable damage, at Isabela, May 22, 1941. (LFM.)

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adult weevils, feeding on the foliage and causing damages of economic importance on trees at El Verde Plantation, Río Grande, altitude 800 ft.; at Río Abajo Plantations, altitude 1,200 ft.; at Utuado, April 20, 1941; adults very abundant, destroying the young tender shoots of trees, near the Recreational Area, at El Yunque Mts., 1,400 ft., June 16, 1940. (LFM.)

Swietenia

Insects Affecting the Roots

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Larvae of the curculionid, attacking the roots of young seedlings at the Mountain Top Nurseries at Patillas, killing many seedlings, (SIB:103), 1939. (GNW. & LFM.)

Swietenia mahagoni Jacq.

(Meliaceae)

DISTRIBUTION: A tree, originally abundant in the valleys and on the hillsides of Puerto Rico, today all but extinguished due to its enormous use. Nowadays it is widely used in reforestation projects. Recorded also from St. Croix, St. Thomas, Florida, Bermuda, Bahamas, Jamaica, Cuba and Hispaniola.

USES: The wood is brown or reddish, strong, hard and tough, with a specific gravity of about 0.7. It is one of the most valuable forest products of tropical America, esteemed for furniture, interior trimming, flooring, and many other purposes.

COMMON NAMES: "Caoba," "Caoba dominicana," "West Indian mahogany" and Mahogany.

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Saissetia oleae (Bernard)

Listed (IB:133).

Chrysomphalus dictyospermi (Morgan)

Listed in (IB:139).

COLEOPTERA**Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) Adults feeding on the foliage of trees, abundant, at Colonia Algarrobo, Guayama, June 12, 1940. (LFM.)

Swietenia

LEPIDOPTERA

Hypsipyla grandella (Zeller)

(Phycitidae) Caterpillar boring in shoots of trees, at Camp Patillas, Patillas, May 1940. Adults reared from material collected at the field. (LFM.)

Monoleuca albicollis Forbes

(Limacodidae) Larvae feeding on leaves, many cocoons observed. Río Piedras, altitude 350 ft., Sept. 23, 1943 (Dr. A. Bonnet, Coll.).

Insects Affecting the Branches

COLEOPTERA

Trichodesma sp.

(Anobiidae) Reared from branches of tree, infested by the larvae of this species, boring inside, Guánica Insular Forest, May 20, 1940. (D. DeLeón & LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) **costalis** (Holmgren)

(Termitidae) Nest in heartwood of live mahogany stump at Aguadilla, 1940; nest on tree at Aguadilla, 1939, (SIB:43). Nest on old tree, about 40 years old, tunnels around the trunk, at Colonia Algarrobo, Guayama, June 12, 1940. (LFM.)

COLEOPTERA

Polycesta porcata Fabricius

(Buprestidae) Larvae in introduced mahogany from Santo Domingo (Island of Hispaniola) to Puerto Rico. Adult reared from furniture recently constructed, from imported timber, at Río Piedras, (SIB:88), 1940. (LFM.)

Apate monachus Fabricius

(Bostrychidae) Larvae, pupae and adults in logs, at Mayagüez, after trees infested were chopped down, at the Mayagüez Nurseries; hundreds of 3 or 4 years old trees, with their trunks bored by adult beetles at Mr. Mario Mercado's Plantation, at Guayanilla, (SIB:94); at Río Abajo Plantation, Utuado, altitude 1,200 ft.; also at Susua Unit attacking several trees, 1940. (LFM.) Listed from Mayagüez, in (IB:243).

Swietenia**Lyctus caribeanus** Lesne

(Lyctidae) In sapwood made into furniture, presumably the timber was infested at the field, (SIB:95), 1939. (LFM.)

HYMENOPTERA**Crematogaster steinheili** Forel

(Formicidae) Breeding under the bark of many trees, at Colonia Algarrobo, Guayama, June 12, 1940. (LFM.)

Xylocopa brasilianorum (Linnaeus)

(Xylocopidae) Breeding on dead part, on a large branch of a very old tree. Larvae burrowing into the live wood, making tunnels; pupae and very recently emerged adults found in the bores, at Colonia Algarrobo, Guayama, June 12, 1940. (LFM.)

Symplocos*Symplocos martinicensis* Jacq.

(Symplococaceae)

DISTRIBUTION: A tree, growing in thickets and on wooded hills, in the northern districts of Puerto Rico. Also recorded from St. Thomas, Tortola and from Saba to Trinidad.

USES: The light colored, fairly heavy, hard and strong wood, has no special use in the Island.

COMMON NAMES: "Aceituna," "Aceituna blanca" and "Aceituna cimarrona."

INSECT RECORDS**HOMOPTERA****Chrysomphalus personatus** (Comstock)

(Coccidae) At Bayamón, listed (IB:140), 1916. The host tree is listed as *S. latifolia* = *S. martinicensis* Jacq.

Tabebuia

Tabebuia argentea (Bur. & Schum.) Britton

(Bignoniaceae)

DISTRIBUTION: A tree, native to Paraguay, introduced and planted at St. Croix and at the Mayagüez Agricultural Experiment Station. Many trees also planted in the University of Puerto Rico grounds.

USES: Planted as an ornamental.

COMMON NAME: "Roble" and "Roble de plata."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Eulepte concordalis Hübner

(Pyraustidae) Slight infestation, caterpillars webbing leaves on trees, at the University grounds, Sept. 22 1940. (LFM.)

Pachymorphus subductellus Möschler

(Chrysaugidae) Many twigs attacked by the borer, on trees at the University grounds, at Río Piedras, Sept. 22, 1940. (LFM.)

Tabebuia haemantha (Bert.) DC.

(Bignoniaceae)

DISTRIBUTION: A shrub or a small tree, growing in woodlands and on hillsides, at lower and middle elevations, in the western, central and southern districts of Puerto Rico. Most abundant in dry regions extending east of Guayama. Endemic.

USES: Very little used, except for fuel.

COMMON NAME: "Roble colorado."

INSECT RECORDS

Insects Affecting the Twigs

LEPIDOPTERA

Pachymorphus subductellus Möschler

(Chrysaugidae) Caterpillar a twig borer on this tree, many of them

Tabebuia

attacked, near Salinas, on the Cayey road, 200 ft. altitude, May 5, 1940. (LFM.)

HYMENOPTERA**Apanteles** sp.

Reared from the gallery of a twig borer larva or caterpillar, presumably *Pachymorphus subductellus* Möschler, at Salinas, May 5, 1940 (det : Muesebeck) (D. DeLeón) (LFM.).

Tabebuia heterophylla (DC.) Britton

(Bignoniaceae)

DISTRIBUTION: A tree, growing in woodlands and thickets, mostly at lower elevations in dry districts of Puerto Rico. Also recorded from Mona, Culebra, Vieques, St. Thomas, St. Jan, Tortola, Virgin Gorda, Anegada, Jamaica, Cayman Islands and St. Barts.

USES: Wood whitish, fairly heavy, not much used in Puerto Rico. In other parts of tropical America, the wood is used for furniture, posts, piles, house building and musical instruments.

COMMON NAMES: "Prieto" and "Roble prieto."

INSECT RECORDS**Insects Affecting the Leaves****LEPIDOPTERA****Eulepte concordalis** Hübner

(Pyraustidae) Caterpillars webbing leaves, on trees at Mona Island, not especially abundant, (SIB:130), 1940. Listed as *Mesocondyla concordalis* Hübner. (LFM.)

Insects Affecting the Twigs**LEPIDOPTERA****Pachymorphus subductellus** Möschler

(Chrysaugidae) Larvae boring in twigs of trees, at Guánica Insular Forest and at Mona Island, (SIB:127), 1940. (Listed as *Pseudo-*

Tabebuia

hemiceras krugii Möschler which I believe is a misidentification: Martorell.) Heavy infestation of trees, at El Vigía, Ponce, many pupal cases observed inside the bores adults already emerged, Ponce, May 22, 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels and nests, on trees at the Guánica Insular Forest, April 1942. (LFM.)

Tabebuia lucida Britton

(Bignoniaceae)

DISTRIBUTION: A tree, having a very limited distribution, found only on the limestone cliffs of Mona Island. Endemic.

USES: Very little use, except for fuel.

COMMON NAME: "Roble de Mona."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Eulepte concordalis Hübner

(Pyraustidae) Webbing leaves of trees, at Mona Island, (SIB:130), 1940. Listed as *Mesocondyla concordalis* Hübner. (LFM.)

Insects Affecting the Twigs

LEPIDOPTERA

Pachymorphus subductellus Möschler

(Chrysaugidae) Boring in twigs of trees, at Mona Island, (SIB:127), 1940. Listed as *Pseudohemiceras krugii* Möschler, undoubtedly a misidentification: Martorell.

Tabebuia*Tabebuia pallida* Miers

(Bignoniaceae)

DISTRIBUTION: A tree, growing in woodlands, thickets and on hillsides, at lower and middle elevations, in wet or moist districts of Puerto Rico. Also recorded from St. Jan, St. Croix, St. Thomas, Bermuda, Hispaniola, from Saba to Trinidad, Central America and Venezuela.

USES: The white, strong and hard wood, has a specific gravity of about 0.8 and is valued for construction, furniture and musical instruments. Locally the tree is extensively planted along roadsides, streets, and gardens, as an ornamental. In Europe the wood has been employed as a substitute for boxwood in engraving. In Cuba, a decoction made with parts of the tree, taken internally is used as a remedy for snake bites. The powdered bark and leaves were formerly used in the Antilles as a febrifuge.

COMMON NAMES: "Roble," "Roble blanco," West Indian boxwood and White cedar.

INSECT RECORDS**Insects Affecting the Pods****LEPIDOPTERA****Ethnistis munitalis** Lederer

(Chrysaugidae) Caterpillar in seed pods, (IB:470). Destroying pods of trees, at San Sebastián, on the Quebradillas road, altitude 1,000 ft., May 1941. (LFM.)

Insects Affecting the Leaves**HOMOPTERA****Jassus obligatus** Osborn

(Cicadellidae) At Ponce, listed (IB:86).

Protalebra tabebuiae Dozier

(Cicadellidae) Listed (IB:90). Causing intense chlorosis on foliage of trees, at San Sebastián, on the Quebradillas road, altitude 900 ft., Sept. 3, 1940. Same type of injury on trees, on the San Lorenzo-Patillas road, altitude 600 ft., May 1942. (LFM.)

Aphis gossypii Glover

(Aphididae) On leaves, at Cayey, (SIB:54), 1940. Abundant on young shoots and tender leaves of trees, at Humacao, on the Yabucoa road, parasitized by minute wasps, May 24, 1940. (LFM.)

Tabebuia

COLEOPTERA

Diomus roseicollis Mulsant

(Coccinellidae) At Cayey, (SIB:92), 1940. Predaceous on *Aphis gossypii* Glover. Listed as *Scymnus roseicollis* Mulsant. (LFM.)

Megistops lituratus (Olivier)

(Chrysomelidae) At Ponce, listed (IB:284). Possibly feeding on the foliage.

LEPIDOPTERA

Eulepte concordalis Hubner

(Pyraustidae) On leaves of trees, at Dorado, (IB:459), 1922. At Maunabo, (SIB:130), 1940. The most destructive pest on the foliage of this tree, the caterpillars webbing leaves and causing tremendous defoliation. At Rio Piedras, Yabucoa, San Lorenzo, El Yunque Mts., at altitudes from sea-level up to 2,000 ft. 1936-42. (LFM.)

Hyblaea puera (Cramer)

(Hyblaeidae) Caterpillars feeding on leaves, abundant, at Guaynabo and Comerío (IB:479), 1922.

Oiketicus kirbyi Guilding

(Psychidae) Bagworms on tree, at Aibonito, (SIB:137), 1938.

HYMENOPTERA

Aphidius testaceipes (Cresson)

(Braconidae) Reared from aphids, *Aphis gossypii* Glover, attacking shoots and tender foliage of trees, at Humacao, many aphids parasitized, May 24, 1940. (GNW. & LFM.)

Elachertus sp.

(Eulophidae) Parasitic on the caterpillar of the "roble" leaf-webber, *Eulepte concordalis* Hübner, collected at San Sebastian, altitude 1,000 ft., Nov. 26, 1940. (det: Muesebeck, as: "sp. nov.") (LFM.)

Insects Affecting the Twigs

HOMOPTERA

(Coccidae)

Howardia biclavis (Comstock)

At Naguabo, (IB:135), 1914. Also at Vega Alta (SIB:60).

Tabebuia**Aspidiotus herculeanus** Hadden

On *Tabebuia*, at Vega Alta, (SIB:61).

LEPIDOPTERA**Pseudohemiceras krugii** Möschler

(Phalaenidae) Caterpillar boring in twigs, listed (IB:436), 1916.

Pachymorphus subductellus Möschler

(Chrysaugidae) Caterpillar boring in twigs, listed (IB: 470), 1912. Presumably this species is the common borer in the twigs of "roble," attacking the tree in all parts of the island in high and low altitudes, recorded from Yabucoa, Ponce, Salinas, Mayagüez, Arecibo, Luquillo, Naguabo, etc. 1937-1942. (LFM.)

Insects Affecting the Trunk**ISOPTERA****Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nest on tree at Lares, (SIB:43), 1940. Nests and tunnels on trunk of trees, at Islote-Vigía road, near Arecibo, Dec. 1, 1940. Near Arroyo, very abundant on trees, along the roadsides, June 12, 1940. (LFM.)

COLEOPTERA**Stizocera vanzwaluwenburgi** Fisher

(Cerambycidae) Infesting "roble" logs at Trujillo Alto. Oct. 1935 (Det : Fisher) (LFM.).

Tabebuia

Tabebuia rigida Urban

(Bignoniaceae)

DISTRIBUTION: A tree, growing in the forests, in the eastern mountains of Puerto Rico, at higher elevations. Endemic.

USES: The brown, hard and durable wood, has no use locally.

COMMON NAME: "Roble de sierra."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Eulepte concordalis Hübner

(Pyraustidae) Out of a large patch of trees, nearly fifty per cent of the leaves were attacked by the caterpillars, on Mt. Britton, El Yunque Mts., altitude 2,600 ft., July 14, 1940.

Oiketicus kirbyi Guiding

(Psychidae) Bag-worms on leaves of tree, at Camp Patillas, on the mountains northeast of the Camp site, May 15, 1940. (LFM.)

Insects Affecting the Twigs

LEPIDOPTERA

Pachymorphus subductellus Möschler

(Chrysaugidae) Boring in twigs, trees at the Carite Unit, altitude 1,800 ft., and also at the Patillas Range, altitude 2,500 ft., May 17, 1940. (LFM.)

Tabebuia schumanniana Urban

(Bignoniaceae)

DISTRIBUTION: A tree, growing in the forests of the western mountains of Puerto Rico, at middle and higher elevations. Endemic.

COMMON NAME: "Roble colorado."

Tabebuia

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA**Eulepte concordalis** Hubner

(Pyraustidae) Caterpillars abundant feeding and webbing leaves, of trees, at the Carite Unit, altitude 2,300 ft., May 17, 1940. Many caterpillars on foliage of trees, near Cerro de Punta, Jayuya, 3,000 ft. altitude, April 1941. (LFM.)

Tamarindus*Tamarindus indicus* L.

(Caesalpiniaceae) .

DISTRIBUTION: A tree, native to Abyssinia and Central Africa, introduced into Puerto Rico, now growing along roadsides and on hillsides at lower elevations. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan and Tortola. (In Britton & Wilson, Vol. 5, p. 365 as: *Tamarindus indica* L.)

USES: The wood is highly esteemed for handles of tools, such as axes, hoes, "machetes," and for furniture and general construction.

COMMON NAMES: "Tamarindo" and Tamarind.

INSECT RECORDS

Insects Affecting the Pods

COLEOPTERA**Palembus ocularis** Casey

(Tenebrionidae) All stages in pods, feeding on the seeds, at Loíza, (IB:235), 1921.

Tribolium castaneum (Herbst)

(Tenebrionidae) In dry pods, at Guánica, (IB:236), 1914. Listed as *T. ferrugineum* (Fabricius).

Tamarindus

Sitophilus linearis (Herbst)

(Curculionidae) According to Dr. Gundlach, this species feeds on the seeds of the tamarind tree. Found in pods at Guánica, Loíza, Cabo Rojo, Ponce and Río Piedras, (IB:317), 1913-21.

Stephanoderes buscki Hopkins

(Scolytidae) Reared to adults from larvae collected in pods at Trujillo Alto, (IB:475). Also at Arecibo, (SIB:133).

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Fulgoridae)

Ormenis pruinosa (Say)

At Mayaguez, listed (IB:103).

(Coccidae)

Pseudococcus brevipes (Cockerell)

At Mayaguez, listed (IB:123).

Pseudococcus maritimus (Ehrhorn)

At Mayaguez, (IB:125).

Saissetia hemisphaerica (Targioni)

Listed (IB:132).

Saissetia oleae (Bernard)

Listed, (IB:133), at Ponce.

Aonidiella orientalis (Newstead)

At Arecibo, (SIB:60). Listed as: *Aspidiotus cocotiphagus* (Marlatt)

Selenaspidus articulatus (Morgan)

At Ponce, listed (IB:138), and recorded as *Pseudaonidia articulatus* Morgan.

Tamarindus**COLEOPTERA****Diaprepes abbreviatus** (Linnaeus)

(Curculionidae) Listed (IB:298), presumably feeding on the foliage.

Apodrosus argentatus Wolcott

(Curculionidae) At Ponce, listed (IB:303).

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Tunnels and nests on trunk of trees, at Arroyo, Salinas, Patillas and Ponce, May 1941. (IFM.)

COLEOPTERA**Apate monachus** Fabricius

(Bostrychidae) At Tallaboa, in dead tamarind, listed (IB:244).

Xylomeira torquata (Fabricius)

(Bostrychidae) In dead branch, at Tallaboa, (IB:244)

Tamonea

Tamonea guianensis Aubl.

(Melastomaceae)

DISTRIBUTION: A shrub or a small tree, growing in woodlands and forest, ascending to higher elevations, in wet or moist districts of Puerto Rico. Also recorded from Tortola, Jamaica, Cuba, Hispaniola, from St. Kitts to Trinidad and continental tropical America.

USES: The wood is used for posts, fuel and charcoal.

COMMON NAMES: "Camasey blanco" and "Camasey de costilla."

Tamonea

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Kaloterмес (Glyptotermes) pubescens Snyder

(Kalotermitidae) In stump of tree, at El Yunque Mts. (SIB:42), 1939. (GNW.)

Tecoma

Tecoma stans (L.) H.B.K.

(Bignoniaceae)

DISTRIBUTION: A shrub or a small tree, growing on hillsides, in the southern districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Florida, Cuba, Jamaica, Hispaniola and continental tropical America.

USES: The tree is planted along roadsides and gardens, as an ornamental, in Puerto Rico. In Mexico, the Indians use the flexible wood to make bows. Powerful diuretic, tonic, antisiphilitic and vermifugal properties are attributed to the plant as well as roots.

COMMON NAMES: "Roble amarillo," "Ruibarba," Trumpet flower, Yellow elder, Yellow cedar and Ginger Thomas.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Protoparce rustica (Fabricius)

(Sphingidae) According to Dr. Möschler, p. 110, the caterpillar of this species, breeds on this tree. Listed (IB:445).

Tectona*Tectona grandis* L.

(Verbenaceae)

DISTRIBUTION: A tree, native to the East Indies, introduced into Puerto Rico for reforestation purposes. Also recorded from St. Croix.

USES: The wood is very valuable, and is used in the construction of furniture, cabinet work and general construction.

COMMON NAMES: "Tetona," "Teca" and Teak.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA

(Coccidae)

Coccus viridis (Green)

Few scale insects on the undersides of the leaves, on trees at Camp Patillas, May 14, 1940, (SIB:59). (LFM.)

Saissetia hemisphaerica (Targion)

Slight infestation, attended by fire ants, at Camp Patillas, May 14, 1940. (LFM.)

Saissetia oleae (Bernard)

Few on the undersides of the leaves of trees, at Camp Patillas, May 14, 1940, (SIB:60). (LFM.)

Pinnaspis minor (Maskell)

On trees, at Patillas, very few on the undersides of leaves, most of them on the trunk, at Camp Patillas, 1940. (LFM.)

HYMENOPTERA**Solenopsis geminata** (Fabricius)

(Formicidae) Attending scale insects, on trees, at Camp Patillas, very abundant, May 14, 1940, (SIB:49). (LFM.)

Insects Affecting the Trunk

HOMOPTERA**Pinnaspis minor** (Maskell)

(Coccidae) Not a serious infestation; on the trunk of some trees, at Camp Patillas, 1940. (LFM.)

Terminalia*Terminalia catappa* L.

(Terminaliaceae)

DISTRIBUTION: A tree, growing on hillsides and sand dunes, mostly near or along the coasts, in Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Virgin Gorda, Cuba, Jamaica, Hispaniola and continental tropical America.

USES: The brownish hard and strong wood, is used for furniture and in construction. The tree is planted for shade, along the roadsides in Puerto Rico. The high tannin content of the roots, bark and fruits makes the tree useful in the tanning industry. The ripe seeds are eaten like almonds.

COMMON NAMES: "Almendra," "Almendro," "Almendrón," Malabar almond and Indian almond.

INSECT RECORDS

Insects Affecting the Fruits

COLEOPTERA

Stelidota geminata (Say)

(Nitidulidae) From the ectocarp of fruits at Añasco, (IB:220).

Stephanoderes brazilensis Hopkins

(Scolytidae) At Arecibo, from fruits, (IB:317).

DIPTERA

Frontina bigeminata Curran

(Larvaevoridae) From fruits, at Vega Alta, (SIB:116).

Anastrepha unipuncta Seín

(Tephritidae) Reared at Río Piedras and Mayagüez, from fruits (IB:378). Also from fruits, at Bayamón, Corozal, Dorado, Manatí and Arecibo, (SIB:120).

LEPIDOPTERA

Ephestia cautella (Walker)

(Phycitidae) From fruits, at Dorado, (SIB:133).

Laspeyresia sp.

(Olethreutidae) At Arecibo, (SIB:135).

Terminalia**Insects Affecting the Leaves and Twigs****THYSANOPTERA****Selenothrips rubrocinctus** (Giard)

(Thripidae) At Bayamón, (IB:65). At Maunabo and Dorado (SIB:49), 1940. Attacking the undersides of leaves and causing a yellowing or discoloration, sometimes the leaves looking silvery or whitish at a distance. Heavy infestations at Maunabo, Isabela, Quebradillas, Lares, from Sept. to Dec. 1940. (LFM.)

HOMOPTERA

(Membracidae)

Monobelus fasciatus (Fabricius)

At Bayamón, (IB:75). Presumably on the twigs.

(Cicadellidae)

Cicadella sirena Stål

At Arecibo, (IB:79).

Protalebra tabebuiae Dozier

At Bayamón, listed (IB:90).

(Fulgoridae)

Ormenis marginata (Brunnich)

Listed (IB:102).

(Aphiidae)

Aphis gossypii Glover

At Bayamón, presumably on the foliage, (IB:114).

(Coccidae)

Pseudococcus virgatus (Cockerell)

At Manatí, (IB:128), 1922.

Coccus viridis (Green)

On the undersides of leaves, very abundant, at Mona Island, (SIB:59), 1939. (LFM.)

Saissetia nigra (Nietner)

Mr. A. Busek, collected the scale insect on this tree species, at San Juan, 1899.

Terminalia**Saissetia oleae** (Bernard)

At Mayagüez and Guánica (IB:133). Abundant on twigs, few on the undersides of leaves, at Mona Island, (SIB:60), 1939. (LFM.)

Aspidiotus destructor Signoret

At Arecibo and Mayaguez, (IB:138). At Bayamón and Mayagüez, more recently, (SIB:61).

Chrysomphalus aonidum (Linnaeus)

Recorded by Mr. A. Busek, at San Juan, 1899, (IB:139). Also recorded by Mr. Van Zwaluwenburg.

COLEOPTERA**Phyllophaga vandinei** (Smyth)

(Scarabaeidae) On foliage, at Mayagüez, (IB:249), 1923.

Cryptocephalus tristiculus Weise

(Chrysomelidae) At Arecibo, (IB:267).

Attelabus sexmaculatus Chevrolat

(Curculionidae) At Bayamón, (IB:290), 1921 and 1933. Presumably this insect was resting on the foliage, not rolling the leaves, as it does in *Psidium*. (Note: LFM.)

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) At Manatí (IB:298) and Arecibo. Causing defoliation of trees, at Arecibo and Punta Borinquen near Aguadilla, on Aug. 30, and May 30, 1940 respectively. (LFM.)

Exophthalmodes roseipes (Chevrolat)

(Curculionidae) Causing injury to the foliage, on trees at Punta Borinquen, Aguadilla, May 30, 1940. Counted as much as 25 adults on a single leaf. (LFM.)

LEPIDOPTERA**Oiketicus kirbyi** Guilding

(Psychidae) According to Dr. Möschler, p. 122, the caterpillar of this species feeds on *Terminalia*, (undoubtedly referring to this tree species). Many trees defoliated at La Muda, on the Caguas-Río Piedras road, (SIB:137), 1938. (LFM.)

Megalopyge krugii (Dewitz)

(Megalopygidae) Listed (IB:505). Caterpillars on foliage at Arecibo, (SIB:138), 1938. (LFM.)

Terminalia

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Many trees, with nests and tunnels on trunk, infested by termites, at Naguabo, Aug. 26, 1940. Also at Yabucoa, Maunabo, San Germán, Mayaguez, Lares, Arecibo, Bayamón, Fajardo, Luquillo Arroyo, etc. June 1941. (LFM.)

Ternstroemia*Ternstroemia stahlii* Krug & Urban

(Theaceae)

DISTRIBUTION: A small tree, growing in sandy soils near Bayamón and at El Cerro de las Mesas at Mayagüez, Puerto Rico. Endemic. (In Britton & Wilson, Vol. 5, p. 581 as: *Taonabo stahlii* (Krug & Urban) Britton.)

COMMON NAME: "Mamey del cura."

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Asterolecanium pustulans (Cockerell)

At Dorado, listed (SIB:57).

Chrysomphalus aonidum (Linnaeus)

At Dorado, listed (SIB:61).

Tetragastris

Tetragastris balsamifera (Sw.) Kuntze
(Burseraceae)

DISTRIBUTION: A tree, growing in forest, woodlands and along creeks. at lower and middle elevations, mostly in wet or moist districts of Puerto Rico. Also recorded from St. Croix, Cuba, Hispaniola and Guadeloupe.

USES: The wood is fragrant, strong, light and durable and is used in carpentry work.

COMMON NAMES: "Masa," "Palo de aceite," "Masa colorado," "Palo de masa" and "Copal."

INSECT RECORDS

Insects Affecting the Twigs

COLEOPTERA

Hypothenemus sp.

(Scolytidae) Adults and larvae breeding in dry twigs, tree in the mountains between Ciales and Jayuya, altitude 1,500 ft., May 1940. (D. DeLeón.) (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) *costalis* (Holmgren)

(Termitidae) Tree infested, at Salinas, on the Cayey road, altitude 900 ft., Oct. 29, 1941. (LFM.)

Tetrazygia

Tetrazygia claeagnoides (Sw.) DC.

(Melastomaceae)

DISTRIBUTION: A tree, growing in thickets, woodlands and on hillsides, at lower and middle elevations, in dry and moist districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Montserrat and Hispaniola.

COMMON NAMES: "Cenizo," "Verde seco" and "Kre-kre."

Tetrazygia**INSECT RECORDS****Insects Affecting the Leaves****HOMOPTERA****Pseudococcus nipae** (Maskell)

(Coccidae) Listed (IB:127), 1914.

Insects Affecting the Twigs**HYMENOPTERA****Camponotus ustus** Forel

(Formicidae) At San José, listed (IB:556), 1923. Presumably boring in the twigs or branches.

Thespesia*Thespesia populnea* (L.) Soland

(Malvaceae)

DISTRIBUTION: A tree, growing in thickets, coastal woods and borders of mangrove swamps, at lower elevations in Puerto Rico. Also recorded from Vieques, St. Croix, St. Jan, St. Thomas, Florida, Bermuda, Cuba, Jamaica, Hispaniola, continental tropical America and the Old World tropics.

USES: The wood has very little use locally. Elsewhere, in the tropics, it is used for cabinet work, building and other purposes. The tree is often planted for shade and ornament in Puerto Rico and the Virgin Islands. In the south coast of Puerto Rico, it is extensively used as a roadside tree.

COMMON NAMES: "Emajagüilla," "Palo de jaqueca," "Santa María," Cork-tree, Spanish cork, Bendy tree and Otaheite.

Thespesia

INSECT RECORDS

Insects Affecting the Pods

HEMIPTERA

(Pyrrhocoridae)

Dysdercus andreae (Linnaeus)

Listed (SIB:71). Recorded by Mr. Fife, as affecting pods of tree.

Dysdercus sanguinarius Stål

Listed (SIB:71). Recorded by Mr. Fife, as affecting pods of tree.

COLEOPTERA

Stephanoderes ferrugineus Hopkins

(Scolytidae) In pods of tree, at Guayanilla, (SIB:105), 1939. Listed as: "sp. near *ferrugineus*."

LEPIDOPTERA

Pectinophora gossypiella (Saunders)

(Gelechiidae) The caterpillar infesting pods of this tree, very often. (LFM.)

Ereunetis minuscula Walsingham

(Tineidae) In partitions of pods at Guayanilla, (IB:501), 1921.

Insects Affecting the Twigs

HOMOPTERA

Pinnaspis minor (Maskell)

(Coccidae) Listed (SIB:60), presumably on the twigs or perhaps on the trunk.

Thevetia

Thevetia nereifolia Juss.

(Apocynaceae)

DISTRIBUTION: A shrub or a small tree, growing in coastal thickets, in Puerto Rico. Also recorded from St. Thomas, St. Croix, St. Jan, Florida,

Thevetia

Cuba, Jamaica, Hispaniola and continental tropical America. (In Britton & Wilson, Vol. 6, p. 91 as: *Cerbera Thevetia* L.)

USES: Locally it is commonly planted for ornament in gardens and "patios."

COMMON NAMES: "Caballón," "Cabalonga," Milk tree and Lucky-nut.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Paradosis flegia (Cramer)

(Pyraustidae) At Plantaje (IB:462), 1916. At Fortaleza gardens in San Juan, (SIB:131), 1937. (Listed as *Margaronia phlegia* Cramer.)

Thrinax

Thrinax microcarpa Sarg.

(Arecaceae)

DISTRIBUTION: A palm, growing on limestone cliffs and hillsides, mostly in the dry southwestern districts of Puerto Rico. Also recorded from Mona, Florida, Bahamas and Cuba.

USES: Occasionally planted for ornament; its leaves are used for making native brooms.

COMMON NAMES: "Palma de escoba" and "Pandereta."

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) On trunk of palms, at Río Abajo Plantations, 1,200 ft. high, Utuado, April 20, 1941. (LFM.)

Thuja

Thuja orientalis L.

(Pinaceae)

DISTRIBUTION: A slow growing tree, found in gardens and parks, occasionally planted after its introduction into Puerto Rico.

USES: Planted as an ornamental.

COMMON NAMES: "Tuya," "Ciprés," Thuja and Asiatic arbor vitae.

INSECT RECORDS

LEPIDOPTERA

Oiketicus kirbyi Guiding

(Psychidae) Very abundant, feeding on the foliage of trees, around the lily-pool, at the U. S. Forest Service grounds, Río Piedras. Also At Ponce, (IB:502). (GNW.) (LFM.)

Thouinia

Thouinia portoricensis Radlk.

(Sapindaceae)

DISTRIBUTION: A shrub or a small tree, growing in woodlands and thickets at lower elevations in the dry southwestern districts of Puerto Rico. Endemic. (In Britton & Wilson, Vol. 5, p. 526 as: *Thyana portoricensis* (Radlk.) Britton.)

COMMON NAMES: "Quebracho," "Quebra hacha," "Serrasuela" and "Serrezuela."

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Syllepis marialis Poey

(Pyraustidae) A leaf-roller, especially abundant on the trees when they are under shady situations; caterpillar small, green; not very abundant, at Guayanilla, Jan. 10, 1941. (det: Heinrich) (LFM.).

Torrubia

Torrubia fragans (Dum.-Cours.) Standley

(Nyctaginaceae)

DISTRIBUTION: A tree, growing in forest, thickets and on hillsides, at lower and middle elevations, in dry and moist districts of Puerto Rico, ascending to 900 meters. Also recorded from Icacos, Culebra, St. Croix, St. Thomas, Tortola, Virgin Gorda, Cuba, Hispaniola, Jamaica, Central and South America.

COMMON NAMES: "Corcho," "Corcho prieto," "Majagua," "Majagua quemona," "Majagua quemadora," "Palo de corcho" and Black Mampoo.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA***Pseudococcus nipae* (Maskell)**

(Coccidae) Leaves infested, on their undersides, at Guajataca Gorge, near Quebradillas, Nov. 17, 1940; also at Yabucoa, on the Maunabo road, altitude 500 ft., Oct. 20, 1940. (LFM.)

COLEOPTERA***Exophthalmodes quindecimpunctatus* (Olivier)**

(Curculionidae) A 21-spotted iridescent weevil, feeding on the foliage of tree, at Yabucoa, (SIB:103), 1940. Listed as *Prepodes 15-punctatus* Olivier. Collected several times, at Yabucoa, during 1940 and 1941; also at Maunabo, at Cabo de Mala Pascua, altitude 150 ft. from August to December, 1940. (LFM.)

***Diaprepes abbreviatus* (Linnaeus)**

(Curculionidae) Weevils feeding on the foliage, at the same time as the above species, at Yabucoa, on the Maunabo road, altitude 500 ft., Aug. 27, 1940; also at Salinas, on the Cayey road, altitude 1,000 ft., on May 1942. (LFM.)

HYMENOPTERA***Isostasius* sp.**

(Platygyasteridae) Reared from galls on the leaves of a tree, at Yabucoa, altitude 500 ft. Presumably parasitic on the larvae of the insect causing the galls. The galls extremely abundant on the foliage, Oct. 20, 1940. (LFM.)

Torrubia

Insects Affecting the Twigs

HOMOPTERA

(Fulgoridae)

Ormenis pygmaea (Fabricius)

Adults abundant on twigs and smaller branches of tree, on the Vigía-Isote road, near Arecibo, Oct. 23, 1940. (LFM.)

Ormenis marginata (Brunnich)

Adults abundant, but not so much as *O. pygmaea* (Fabricius); on twigs, sometimes going under the leaves, at Arecibo, Oct. 23, 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trunk of two large trees, on the Yabucoa-Maunabo road, at 500 and 800 ft. altitude, Oct. 20, 1940; also at Manatí, Sept. 27, 1940. (LFM.)

Trema

Trema lamareckiana (R. & S.) Blume

(Ulmaceae)

DISTRIBUTION: A tree, growing in thickets and on hillsides, in Puerto Rico. Also recorded from Florida, Bermuda, Bahamas, Cuba, Jamaica, Hispaniola and from Saba to St. Vincent.

COMMON NAMES: "Palo de cabrilla" and "Cabrilla."

Trema

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Pseudococcus nipae (Maskell)

Abundant on the undersides of leaves, at El Yunque Mts., altitude 1,800 ft., Sept. 29, 1940. (LFM.)

Pulvinaria psidii Maskell

Not very abundant, but present on twigs and undersides of leaves, on large trees, near Stone House, at Buena Vista Camp, Maricao Insular Forest, altitude 2,200 ft., May 31, 1942. (LFM.)

Saissetia oleae (Bernard)

Few scale insects, on the twigs of a tree, at the Maricao Insular Forest, altitude 2,200 ft., May 31, 1942. (LFM.)

Insects Affecting the Branches and Trunk

ISOPTERA**Nasutitermes** (N.) **costalis** (Holmgren)

(Termitidae) Fairly large tree, on the Cayey-Salinas road, Km. 13.1, attacked by termites, many tunnels on the trunk, Dec. 24, 1940. (LFM.)

HOMOPTERA**Pseudaulacaspis pentagona** (Targioni)

(Coccidae) Heavy infestation on trunk and branches of a young tree, at El Yunque Mts., altitude 1,800 ft., Sept. 29, 1940. (det : Morrison.) (LFM.)

Pinnaspis minor (Maskell)

(Coccidae) Trunk and branches of a tree, at the Maricao Insular Forest, heavily infested, altitude 2,200 ft. May 31, 1942. The scale insect kept under control by means of the larvae and adults of the ladybird beetle, *Chilocorus cacti* (L.).

COLEOPTERA**Chilocorus cacti** (Linnaeus)

(Coccinellidae) Larvae and adult very abundant, feeding on scale

Trema

insects, *Pinnaspis minor* (Maskell), on trunk and branches of a tree, at the Maricao Insular Forest, altitude 2,200 ft., May 31, 1942. (LFM.)

Trema micrantha (L.) Blume

(Ulmaceae)

DISTRIBUTION: A tree, growing in woodlands and on hillsides, in Puerto Rico. Also recorded from St. Jan, St. Croix, St. Thomas, Tortola, Cuba to Trinidad and continental tropical America.

USES: The light brown, weak and soft wood, is locally used for fuel and charcoal.

COMMON NAMES: "Guacimilla" and "Palo de cabra."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Lactica scutellaris Olivier

(Chrysomelidae) In mountains north of Yauco, listed (IB:279), 1921. (Perhaps feeding on the foliage.)

LEPIDOPTERA

Hypanartia paullus (Fabricius)

(Nymphalidae) caterpillar on tree at Ciales and in the mountains north of Yauco, (IB:398), 1921 and 1923. Caterpillar defoliating tree, at El Yunque Mts. altitude 1,800 ft., March 1941. (GNW.)

Insects Affecting the Trunk and Branches

HOMOPTERA

(Coccidae)

Saissetia oleae (Bernard)

Heavy infestation on trunk and branches and even on young twigs of tree, at Aguas Buenas, altitude 800 ft., 1941. (LFM.)

Trema**Pseudaulacaspis pentagona** (Targioni)

Listed (IB:136), 1914, as *Aulacaspis pentagona* Targioni.

Pinnaspis minor (Maskell)

Trunk and branches fully infested by the scale insect, at Aguas Buenas, altitude 800 ft., 1941. (LFM.)

Trichilia*Trichilia hirta* L.

(Meliaceae)

DISTRIBUTION: A tree, growing in thickets, on hillsides, river banks and along creeks at lower elevations in Puerto Rico. Also recorded from Vieques, St. Thomas, St. Croix, St. Jan, Cuba, Jamaica, Hispaniola and continental tropical America.

USES: The stems of young trees are used for broom handles.

COMMON NAMES: "Cabo de hacha," "Guaita," "Retamo," "Jobillo," "Molinillo," "Palo de Anastasio," "Guayavacón," and Broomstick.

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trees, at Salinas, Guánica and Arecibo, Sept. to Dec. 1940; all at low altitudes. (LFM.)

Trichilia pallida Sw.

(Meliaceae)

DISTRIBUTION: A tree, growing in woodlands, forests and valleys, ascending to higher elevations in Puerto Rico. Also recorded from Cuba and Hispaniola.

Trichilia

COMMON NAMES: "Gaeta," "Cabo de hacha," "Caracolillo," and "Ramoncillo."

INSECT RECORDS

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Nest and tunnels on trees, at Salinas, on the Guayama road, Sept. 1940. (LFM.)

Triplaris

Triplaris caracasana Cham.

(Polygonaceae)

DISTRIBUTION: A Venezuelan tree, introduced into Puerto Rico and planted at the Agricultural Experiment Station of Mayaguez and Río Piedras.

USES: Planted as an ornamental and shade tree.

COMMON NAME: "Triplaria."

INSECT RECORDS

Insects Affecting the Leaves

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Weevils feeding on the leaves of a large tree, at the Agricultural Experiment Station grounds at Río Piedras, May 13, 1942. (LFM.)

LEPIDOPTERA

Megalopyge krugii (Dewitz)

(Megalopygidae) Caterpillars feeding on the foliage, pupal cases or cocoons abundant on the branches, on trees at Río Piedras, May 13, 1942. (LFM.)

Triplaris

Insects Affecting the Trunk

Myrmelachista ramulorum (Wheeler)

(Formicidae) Ants abundant under the loose bark of trees at Experiment Station grounds, Río Piedras, Nov. 5, 1943. (GNW.)

Vachellia*Vachellia farnesiana* (L.) Wight & Arn.

(Mimosaceae)

DISTRIBUTION: A tree, growing in thickets at lower elevations, mostly in the dry districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan. Tortola, Virgin Gorda, Florida, Cuba, Jamaica, Hispaniola, continental tropical America and the Old World tropics.

USES: The handsomely grained, heavy, reddish brown wood, is used in construction and wherever strength and durability are required. Probably a very suitable wood for furniture. In southern Europe the flowers are used in the manufacture of perfumes. In Mexico the roots and pods are used medicinally.

COMMON NAMES: "Aroma," "Aromo" and Casha.

INSECT RECORDS

Insects Affecting the Leaves

HOMOPTERA**Heteropsylla mimosae** Crawford

(Chermidae) Very abundant on the foliage, at Guánica and Guayanilla, listed (IB:111), 1913.

Insects Affecting the Fruits

Cathartus gemellatus (Jacq.)

(Cucujidae) At Boquerón, listed (IB:221), 1923, as *Silvanus gemellatus* Jacq.

Loberus testaceus Reitter

(Cryptophagidae) At Boquerón, (IB:223), 1923.

Vachellia

Lepturges guadeloupensis Fleutiaux & Sallé

(Cerambycidae) Reared from pods, at Boquerón, (IB:264), 1923.

Acanthoscelides sallei (Sharp)

(Bruchidae) At Boquerón, listed (IB:286), 1923.

Acanthoscelides dominicanus (Jekel)

At Guánica and Boquerón, listed (IB:287), 1914 and 1923. Listed as *Bruchus dominicanus* Jekel.

Brachytarsoides sp.

(Anthribidae) From pods, at Boquerón, (IB:288), 1923. Listed as *Brachytarsus* sp.

HYMENOPTERA

Horismenus sp.

(Entedontidae) From seed pods of tree, infested with *Bruchus* sp., at Guánica, (IB:523), 1914.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) On trunk of trees at the Guánica Insular Forest, very abundant and many trees attacked, July 1941. (LFM.)

Varronia

Varronia angustifolia West.

(Ehretiaceae)

DISTRIBUTION: A shrub, growing in thickets and on hillsides, in the southern and southwestern dry districts of Puerto Rico, at lower and middle elevations. Also recorded from St. Croix, St. Thomas, Cuba and Hispaniola.

COMMON NAME: "Basora."

Varronia

INSECT RECORDS

Insects Affecting the Leaves and Twigs

HOMOPTERA**Ormenis pygmaea** (Fabricius)

(Fulgoridae) At Guánica, (IB:103), 1913. Host tree listed as *Cordia cylindrostacha* = *V. angustifolia* West.

COLEOPTERA**Phyllophaga guanicana** (Smyth)

(Scarabaeidae) Feeding on leaves of trees, at Guánica, (IB:251). Host tree listed as *Cordia cylindrostacha* = *V. angustifolia* West.

Lachnopus curvipes (Fabricius)

At Yauco, (IB:302), 1913. Host tree listed as *Cordia cylindrostacha* = *V. angustifolia* West.

Varronia corymbosa (L.) Desv.

(Ehretiaceae)

DISTRIBUTION: A shrub, growing in thickets and on hillsides, at lower and middle elevations, in Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Jamaica, Cuba, Hispaniola, from Guadeloupe to Trinidad and continental tropical America.

COMMON NAMES: "Basora prieta," "Palo de perico," "Perico," "Sara-güazo," "Saragüero" and Black sage.

INSECT RECORDS

Insects Affecting the Twigs

HOMOPTERA**Ormenis pygmaea** (Fabricius)

(Fulgoridae) Listed (IB:103), 1912.

Ormenis quadripunctata (Fabricius)

Listed (IB:103), 1912.

Vitex*Vitex divaricata* Sw.

(Verbenaceae)

DISTRIBUTION: A tree, growing in woods, in wet or moist districts of Puerto Rico, ascending to higher elevations. Also recorded from St. Croix, St. Thomas, St. Jan, Cuba, St. Kitts and from Guadaloupe to Trinidad.

USES: The nearly white wood, is hard and durable and is used in cabinet work and construction.

COMMON NAMES: "Higüerillo," "Péndula," "Palo de péndula," "Péndulo blanco," Lizard wood and Fiddle wood. (Br. W. I.)

INSECT RECORDS

Insect Affecting the Leaves

HOMOPTERA

Aspidiotus cyanophylli Signoret
(Coccidae) Listed (IB:137).

COLEOPTERA

Lachnopus coffeae Marshall
(Curculionidae) Listed (IB:300). Perhaps feeding on the foliage of tree.

Rodolia cardinalis (Mulsant)
(Coccinellidae) One specimen collected on the foliage of a tree, apparently looking to prey upon one of its hosts, near Peñón del Collao, altitude 1,800 ft., Cayey, Feb. 2, 1941. (det: Chapin) (LFM.).

LEPIDOPTERA

Pilocrocis inguinalis (Guenée)
(Pyraustidae) Caterpillar a leaf-webber, causing considerable damage on trees, at El Peñón del Collao, altitude 1,800-2,000 ft., Cayey, Jan. 7, 1941. (det: Heinrich, as sp. presumably *inguinalis* (Guenée). (LFM.).

Pyrausta cerata (Fabricius)
(Pyraustidae) Caterpillars abundant on trees, at Aibonito and Trujillo Alto, (IB:467), 1923. Abundant on trees at Patillas, May 1940. (D. DeLeón.)

Vitex**DIPTERA****Argyrophylax albincisa** (Wiedemann)

(Larvaevoridae) One fly reared from a caterpillar of the leaf-webber, *Pilocrocis inguinalis* (Guenée), collected near Peñón del Collao, Cayey, altitude 2,000 ft., Jan. 15, 1941. (LFM.)

HYMENOPTERA**Microgaster** sp.

(Braconidae) Reared from a caterpillar of *Pilocrocis inguinalis*, (Guenée), abundant and many reared from other caterpillars, collected near Peñón del Collao, altitude 2,000 ft., Jan. 7, 1941. (det: Muesebeck, as "sp. nov.") (LFM.)

Eiphosoma insularis Viereck

(Ichneumonidae) Reared from the leaf-roller caterpillar, *Pyrausta cecrata* (Fabricius), collected at Patillas May 1940. (D. DeLeón.) (LFM.)

Insects Affecting the Trunk

ISOPTERA**Nasutitermes (N.) costalis** (Holmgren)

(Termitidae) Nest and tunnels on trunk of a large tree, about 15 inches in diameter, at Lares, altitude 1,200 ft., Nov. 25, 1940. (LFM.)

Zanthoxylum*Zanthoxylum caribacum* Lam.

(Rutaceae)

DISTRIBUTION: A tree, growing in woods and on hillsides at lower elevations in the southern and western districts of Puerto Rico. Also recorded from Guadeloupe, Martinique, Barbados, Mexico and northern South America.

USES: Not used locally.

COMMON NAMES: "Espino rubial," "Rubial" and Bastard prickly yellow (Br. Honduras).

Zanthoxylum

INSECT RECORDS

Insects Affecting the Leaves

HEMIPTERA

Corythucha gossypii (Fabricius)

(Tingitidae) On leaves, adults and nymphs in all stages abundant, (SIB:70). (LFM.)

COLEOPTERA

Diaprepes abbreviatus (Linnaeus)

(Curculionidae) Adults feeding on the foliage, at Isabela, (SIB:103), 1939. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Tunnels on trunk of tree, at El Vigía-Islote road, near Arecibo, Dec. 1, 1940; also on large tree at Guajataca, Nov. 17, 1940. (LFM.)

HYMENOPTERA

Camponotus ustus Forel

(Formicidae) Ants breeding in rotten branches and in the trunk of a tree, at Guajataca Gorge, near Quebradillas, altitude 20 ft., adults and pupae abundant inside bores, Nov. 24, 1940. (LFM.)

Zanthoxylum flavum Vahl.

(Rutaceae)

DISTRIBUTION: A tree, growing on hillsides at low elevations, in the western districts of Puerto Rico and near Quebradillas. Also recorded from St. Jan, Florida, Bermuda, Bahamas, Jamaica, Cuba, Hispaniola and from Montserrat to St. Lucia.

USES: The hard, strong and heavy, yellow wood, is valued for cabinet work, furniture and veneer work.

COMMON NAMES: "Aceitillo," Satinwood and Yellow sander.

Zanthoxylum

INSECT RECORDS

Insects Affecting the Seeds

COLEOPTERA

Apion martinezi Marshall

(Curculionidae) Reared from seeds collected at Guánica Insular Forest. About forty per cent of the seeds infested, on trees at Buena Vista Camp, elevation 2,700 ft., Maricao, reared by E. Martínez, (IB:292), 1932. Further observations during 1939 to 1942, have shown that this insect is very abundant, at Maricao and Guánica Forests, and destroys so many seeds, that very few are left available for reforestation purposes. (LFM.)

HYMENOPTERA

Emersonopsis sp.

(Entedontidae) Many parasitic wasps reared from the seeds, infested by larvae of the weevil, *Apion martinezi* Marshall, collected at the Maricao Insular Forest, July 20, 1941. (LFM.)

Insects Affecting the Leaves and Twigs

HOMOPTERA

(Coccidae)

Asterolecanium pustulans (Cockerell)

Twigs infested, young tree about 12 ft. high, at Santurce, (SIB:57), 1940. (LFM.)

Saissetia oleae (Bernard)

On twigs and the undersides of leaves, abundant, on a small tree, about 12 ft. high, at Santurce, (SIB:57), 1940. (LFM.)

Pinnaspis minor (Maskell)

On twigs and leaves, on a small tree, 12 ft. high, at Santurce, (SIB:60), 1940.

Aonidiella orientalis (Newstead)

On twigs, leaves and even on the trunk, of a small tree, at the Guánica Insular Forest (SIB:60), 1938. Listed as: *Aspidiotus cocotiphagus* (Marlatt). (LFM.)

Zanthoxylum

HEMIPTERA

Corythucha gossypii (Fabricius)

(Tingitidae) Abundant on the undersides of leaves, on trees at the Guánica Insular Forest, causing chlorosis of leaves, also at Santurce, 1940. (LFM.)

HYMENOPTERA

Solenopsis geminata (Fabricius)

(Formicidae) Attending scale insects, infesting a small tree, about 12 ft. high, at Santurce, 1940. Very abundant and with the nest at the base of the trunk; controlled by means of carbolic acid emulsion. (LFM.)

Insects Affecting the Trunk

COLEOPTERA

Chrysobothris megacephala Castelnau & Gory

(Buprestidae) Larvae attacking trunk of tree, at the Guánica Insular Forest, many adults reared, (SIB:88), 1938. (LFM.)

Phloeonemus martorelli Fisher

(Colydiidae) Abundant at the base, on trunk of trees, on gummy exudations, perhaps caused by cuts, with "machetes" (daggers) while clearing the forest. May 1940. (D. DeLeón & LFM.)

Tenebroides sp.

(Ostomidae) Reared from trunk of trees, at the Guánica Insular Forest, April 1940. Larvae and adults collected. (D. DeLeón.)

Elaphidion mutatum Gahan

(Cerambycidae) Larvae in live tree, at the Guánica Insular Forest, collected twice and reared to adults, (SIB:99), 1938. (LFM.)

Leptostylus argentatus J. Duval

(Cerambycidae) Reared from the trunk of a tree, at the Guánica Insular Forest. Abundant and boring in many trees, (SIB:99), 1938. (LFM.)

Zanthoxylum

Zanthoxylum martinicense (Lam.) DC.

(Rutaceae)

DISTRIBUTION: A tree, growing in forest, river valleys, on wooded hills and along creeks, at lower and middle elevations in moist and dry districts of Puerto Rico. Also recorded from Vieques, St. Croix, St. Thomas, St. Jan, Tortola, Jamaica, Cuba, Hispaniola, from Montserrat to Trinidad and northern South America.

USES: The light yellow, hard and strong wood, with a specific gravity of about 0.93, is used for furniture and in carpentry, as well as general construction.

COMMON NAMES: "Cenizo," "Espino," "Espino rubial," "Ayúa," White prickly and Prickly ash.

INSECT RECORDS

Insects Affecting the Leaves

LEPIDOPTERA

Papilio pelaus (Fabricius)

(Papilionidae) Twenty fully-grown caterpillars clustered on tree trunk, on web they had spun, unmoved by ant biting one, or by a lizard running over the group, at Cayey, 1922. Also collected at Barranquitas, (IB 406), 1924.

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) costalis (Holmgren)

(Termitidae) Large tree, with many tunnels on the trunk, termites very active, at Aguas, Oct. 20, 1940. (LFM.)

Zanthoxylum monophyllum Lam.

(Rutaceae)

DISTRIBUTION: A shrub or a small tree, growing in woodlands, thickets, on hillsides and along creeks, at lower elevations, most abundant in the

Zanthoxylum

dry southern districts of Puerto Rico. Also recorded from Vieques, St. Croix St. Thomas, St. Jan, Hispaniola, from Montserrat to Trinidad, Costa Rica and northern South America.

COMMON NAMES: "Carubio," "Mapurito," "Rubia," "Espino rubial" and Yellow prickle.

INSECT RECORDS

Insects Affecting the Leaves

THYSANOPTERA

Selenothrips rubrocinctus (Giard)

(Thripidae) Attacking the foliage of a small tree, at Guayama, causing chlorosis of leaves, Nov. 14, 1940. (LFM.)

HEMIPTERA

Corythucha gossypii (Fabricius)

(Tingitidae) Listed (SIB:70), 1940. Heavy infestation on a small tree, about 10 ft. high. Chlorosis of leaves very noticeable, Guayama, Nov. 14, 1940. (LFM.)

LEPIDOPTERA

Achylodes thraso (Hübner)

(Hesperiidae) Caterpillar feeding on the foliage of tree, at Boquerón, (IB:408), 1923.

Insects Affecting the Twigs

HOMOPTERA

Ormenis pygmaea (Fabricius)

(Fulgoridae) Breeding abundantly on the lower branches and twigs of a small tree, about 10 ft. high, at Guayama, altitude 40 ft., Nov. 14, 1940. (LFM.)

Insects Affecting the Trunk

ISOPTERA

Nasutitermes (N.) **costalis** (Holmgren)

(Termitidae) Tunnels on the trunk of a large tree, at Maunabo, altitude 150 ft., Oct. 20, 1940. (LFM.)

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A SURVEY OF THE FOREST INSECTS OF PUERTO RICO

PART II

(A Discussion of the Most Important Insects Affecting Forest,
Shade and Ornamental Trees in Puerto Rico.)

By LUIS F. MARTORELL

Associate Entomologist, Agricultural Experiment Station

CLASS INSECTA OR HEXAPODA THYSANURA

FAMILY LEPSIMIDÆ

The insects belonging to this family are commonly known as bristle-tails. Two different species belonging to the genera **Lepisma** and **Nicoletia** have been previously recorded as causing pits in the roots of *Bambos vulgaris* Schrad. Seán in 1930, published about this subject. Making reference to these two insects, he says:

"Another cause for puzzling was the continuous finding of another type of feeding cavities or pits which are larger and not so evenly circular as those made by the Symphilid and not located in the cortex of the mature roots but at or near the tips in the tender tissues. These larger pits were not the entrance to tunnels and for a time we attempted to explain them as the work of the larger root caterpillars; but this was unusual because they never developed into tunnels. They were merely feeding pits out of which the tender tissues had been scooped. They could also be found in the roots of *B. vulgaris* (and *G. sagittatum*) on which the root caterpillar does not work.

"A large white bristle-tail (**Nicoletia** sp.) found in the soil near the cane, bamboo and *G. sagittatum* roots was isolated in vials and found to be the cause of the larger pits. Another bristle-tail, smaller and golden-brown in color (**Lepisma** sp.) was also found to produce pits but this latter one is not so abundant as the former. When several bristle-tails in a vial are allowed to work on a root, they may make several pits close

together or even enlarge some of them, but they never make tunnels. Both bristle-tails have been determined by Dr. J. W. Folsom and are probably undescribed species." (Sein, August 1930, p. 177.)

DERMAPTERA

Not knowing exactly the economic importance of the Puerto Rican species of earwigs and their relation to the trees, they are not listed as tree pests on the annotated list in the first part of this work. However, one is apt to find many different species on trees, in such situations as under the bark, in rotten trunks, in old burrows in twigs perhaps caused by twig-borers, etc., and even in abandoned cocoons of the "plumilla", *Megalopyge krugii* (Dewitz). The following are the most common species found on trees:

Euborellia annulipes (Lucas)

Labia curvicauda (Motschulsky)

Labia dorsalis (Burmeister)

Prolabia unidentata (Beauvois)

Doru albipes (Fabricius)

Psalis americana var. **gagathina** (Burmeister)

Of these the most common is *Doru albipes* (Fabricius). This species is usually found in old, abandoned burrows in twigs of trees, breeding inside. On opening one of these bores, it is possible to find eggs, and sometimes young in all stages of development, as well as adults.

Although some species of earwigs are injurious to vegetation and still others are beneficial for their predatory habits, it is difficult to place our species in a relative position in reference to the economic importance as far as trees are concerned, because not enough is known about the life history of the different species.

ORTHOPTERA

FAMILY BLATTIDÆ

The roaches are the insects included in this family and although they are of no economic importance as far as trees are concerned, they are so abundantly found in them under different situations, that it is worthwhile to mention some facts about these insects.

Many tropical species of roaches live on trees, in places such as under the bark, crevices of the trunk, in the roots and between the leaves of bromeliaceous plants on the tree trunk and branches, in old, abandoned leaf-webbers nests and even in abandoned cocoons of the "plumilla", *Megalopyge krugii* (Dewitz). Presumably all the species feed upon the

decayed vegetable matter and some perhaps act as scavengers. The following species are commonly seen on trees:

Aglaopteryx absimilis Gurney

Aglaopteryx diaphana (Fabricius) = ***A. devia*** Rehn

Caribblatta stenophrys Rehn & Hebard

Panchlora sagax Rehn & Hebard

Hemiblabera brunneri (Saussure)

Plectoptera dorsalis (Burmeister)

Plectoptera rhabdota Rehn & Hebard

Of these, the most common are *Aglaopteryx devia* Rehn and *Plectoptera rhabdota* Rehn & Hebard. According to Mr. Gurney of the U. S. National Museum, all records under *A. diaphana* should be placed now under *A. devia* Rehn, because *diaphana* is a Cuban species.

FAMILY TETTIGONIIDÆ

The only representative of this family which is known to do some damage to trees, is the common "esperanza" or katydid, ***Microcentrum triangulatum*** Brunner.

Habits: The eggs of this insect are glued along the edges of the leaves, sometimes on twigs or on the bark of trunks or branches. These are laid in a row, being flat, light gray in color and oval in shape. The writer has been able to observe many of these eggs, with small, round, conspicuous holes on the chorion, which are undoubtedly exit holes of parasitic insects which destroy the eggs.

The young nymphs are variegated and bright colored, later becoming entirely green, except at the distal end of the tibia and angles of short wings, which are brown. In the last instar these nymphs are entirely green, thus resembling to the adult insect. In the early stages of their development the young insects are very voracious, usually preferring the young and tender growth. The adults feed on the young or old foliage.

Host: *M. triangulatum* have been recorded from the following host trees:

Andira jamaicensis (W. Wright) Urban

Coccolobis laurifolia Jacq.

Guaiacum officinale L.

Guarea trichilioides L.

Isandrina emarginata (L.) Britton & Rose

Lagerstroemia speciosa (L.) Pers.

Malpighia fucata Ker-Gawl.

Petitia domingensis Jacq.

"moca"

"uvilla"

"guayacán"

"guaraguo"

"vela muerto"

"reina de las flores"

"olaga"

"capá blanco"

ISOPTERA

This order of insects comprises the so-called termites or white ants. Some of our insular species are very injurious to trees, others are not abundant enough to be of economic importance. With the exception of our common termite or "comején", *Nasutitermes* (*N.*) *costalis* (Holmgren) very little is known about the biology of the other forms affecting our trees.

The following species have been recorded on trees:

FAMILY KALOTERMITIDÆ

***Kalotermes* (*Kalotermes*) *snyderi* Light**

This species is very common in the Island of Mona, not so in Puerto Rico.

Habits: The termite attacks living trees as well as dead wood. It does not build tunnels or nests on the trunk of trees like our common termite or "comején". The work is chiefly inside the wood, making a complicated system of galleries and tunnels. The soldier is characterized by its huge mandibles and head (fig. 1). (Martorell, Jan. 1941, p. 81.)

Host: The following trees have been recorded as affected by this termite. All records are from Mona Island:

<i>Amyris elemifera</i> L.	"tea"
<i>Canella winterana</i> (L.) Gaertn.	"barbasco"
<i>Coccolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Dipholis salicifolia</i> (L.) A. DC.	"sanguinaria"
<i>Bursera simarouba</i> (L.) Sarg.	"almácigo"
<i>Gymnanthes lucida</i> Sw.	"tabaco"
<i>Metopium brownei</i> (Jacq.) Urban	"papayo"
<i>Pithecellobium unguis-cati</i> (L.) Mart.	"rolón"
<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Conocarpus erectus</i> L.	"mangle botón"
<i>Rauwolfia nitida</i> Jacq.	"muñeco"

***Kalotermes* (*Glyptotermes*) *pubescens* Snyder**

This is an interesting species of termite and yet nothing is known to us about its biology. Is a high altitude species dwelling at about 2000 ft. or more in elevation. In one instance the insect was found infesting a trunk of *Ochotea moschata* (Pavon) Mez, at 2,500 ft. in altitude, at the Guavate Unit.

The soldier was described as follows:

"Soldier: Head light yellow-brown, darker anteriorly, where deeply lobed, longer than broad but relatively short, subcylindrical, narrowed slightly at front, highest in center; front rimmed with black, almost vertical, with scattered long, light yellowish hairs on margins and 4 long hairs in a transverse row on dorsum at about middle of head, the 2 inner hairs being slightly shorter than the outer, another row of hairs is on the anterior of the head.

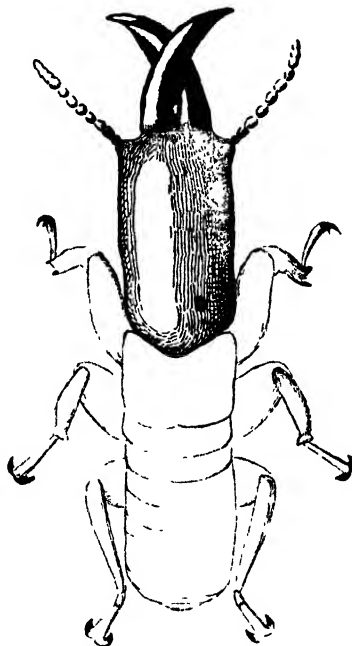


FIG. 1. *Kalotermes* (K.) *snyderi* Light, Soldier (10X). (Drawn by G. N. Wolcott.)

"Antennae light yellow-brown, 10 or 11 segments, a little longer than mandibles, with long hairs, segments become broader toward apex; first segment elongate, cylindrical; second shorter than first, not clavate; third longer than second, clavate, appears to be divided near narrow base, latter however, with no hairs; fourth broader, shorter than third; last segment elongate, subelliptical.

"Eyes pale, large, elongate, subelliptical, near antennal socket.

"Labrum yellow-brown, longer than broad, somewhat tongue-shaped, rounded at apex, with 2 long hairs (longer than labrum) set in center of apex, also with shorter hairs.

"Mandibles blackish, short, not as long as width of head, broad at base,

pointed and incurved at tips; 2 pointed, small marginal teeth near tip and a border tooth near base on left mandible; right mandible with 2 broader marginal teeth nearer base.

"Gula elongate, narrowed in center, not twice as broad at front as in center.

"Pronotum paler than head, twice as broad as long, anterior and posterior margins nearly parallel, anterior corners high, sides rounded, gradually slope to posterior, with long, light-yellow hairs on margins.

"Legs with tibiae and tarsi yellowish, fairly elongate, femora thickened.

"Abdomen gray-white, with long, dense, light-yellow hairs.

"Measurement: Total length of soldier, 5.5 to 6.5 mm." (Described from Aibonito, P. R., see: Snyder, 1924, pp. 10-11.)

Host: The termite has been recorded from the following trees:

Cyrilla racemiflora L.

"colorado"

Ocotea moschata (Pavon) Mez

"nuez moscada"

Tamonea guianensis Aubl.

"camasey blanco"

FAMILY TERMITIDÆ

Nasutitermes (*Tenuirostritermes*) *discolor* (Banks)

A rare species in Puerto Rico. This termite does not build an exterior nest, but just galleries or tunnels on the infested trunk.

Host: Only recorded from "guaba", *Inga vera* Willd. at a coffee plantation at Ciales, P. R., 1922.

Nasutitermes (*Tenuirostritermes*) *wolcottii* Snyder

Another rare species of termite from the Island, which was found years ago, during 1923, at Boquerón, on the south-western corner of Puerto Rico. The insect was described by Dr. T. E. Snyder as follows:

Soldier: "Head yellow-brown (light castaneous), beak darker, head constricted at about middle, with exception of depression at constriction, head and beak are in nearly straight line in profile, head and beak with dense fairly long hairs and head with a few longer hairs, head widest posteriorly where broadly rounded. Small projections on front of head near beak. Beak slender and conical. Mandibler points vestigial (fairly short, slender and pointed.)

"Antennae yellow-brown, with 13 segments, pubescent; third segment subclavate, longer than second; fourth shorter than second segment; segments become longer to apex; last segment shorter, subelliptical.

"Pronotum same color as head, darkest anteriorly where margin is

slightly emarginate, saddle shaped, posterior margin slightly emarginate, margins with long hairs.

"Legs yellow-brown fairly elongate, slender, pubescent.

"Abdomen yellow-brown, tergites with dense fairly long hairs and a row of longer hairs at the base of each tergite". (Snyder, 1924, p. 131; illustration of soldier.)

Measurement of entire soldier: 2.60 mm.

Habits: The tunnels of this species are made out of soil, are broader than those made by the common "comején", being about an inch or more in width. These tunnels lead to no nest but just to the rotten wood of the tree.

Host: On dead wood of "úcar", *Bucida buceras* L.

Nasutitermes (Nasutitermes) acajutlae (Holmgren)

Another species of termite of which very little is known, perhaps due to its scarcity. Recorded only once during 1921, from "algarrobo", *Hymenaea courbaril* L.

Referring to this species, Wolcott in IB., said the following:

"The nest is light brown in color, the outside layers being of uniform brittle character, the interior layers very hard and tough and containing many hard balls about an inch in diameter with two or more narrow tunnels leading to the interior. The exterior tunnel to the ground was nearly an inch broad. Only workers, nasuti and immature stages found (July 8). The workers bit viciously." (IB., p. 49-50.)

Nasutitermes (Nasutitermes) costalis (Holmgren)

(El Comején)

The common termite or "comején" is not only an insular species but it is also scattered throughout the West Indies. It is our most abundant species of termite and is well known by everybody in Puerto Rico.

It constructs large oval nests, about 2 feet in diameter on trees, fence posts, houses, rocks and even on the ground. From this nest or "nigger head", a series of tunnels of carton radiate, connecting it with the ground, by which the termites get their water supply. Each nest represents a complicated social organization, headed by a queen-mother, which is capable of laying eggs at the rate of three per minute or several thousands a day.

Wolcott's latest paper on termites, contains a full discussion of this interesting insect. (Wolcott, March 1939).

The "comején" is perhaps our most destructive termite and the damages

done to trees every year have not been determined yet, but presumably are worth of consideration.

The insect thrives best at low altitudes, especially in the dry forests of Puerto Rico, like the Guánica Insular Forest, Susua Unit and also is common in the mangrove swamps or "manglares" along the coast. At 1,000 ft. in altitude is less abundant and at 2,000 ft. few trees are attacked. From 2,000 ft. up it is seldom observed. (See Plate I, for figures of soldier and worker).

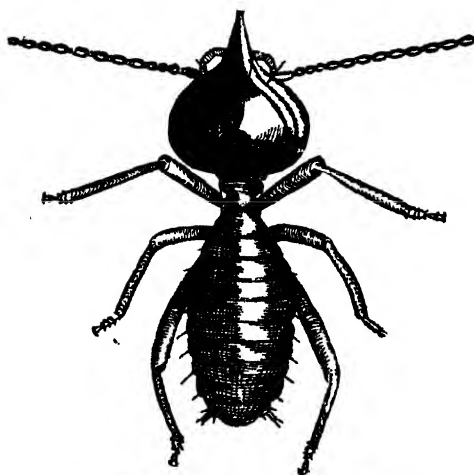
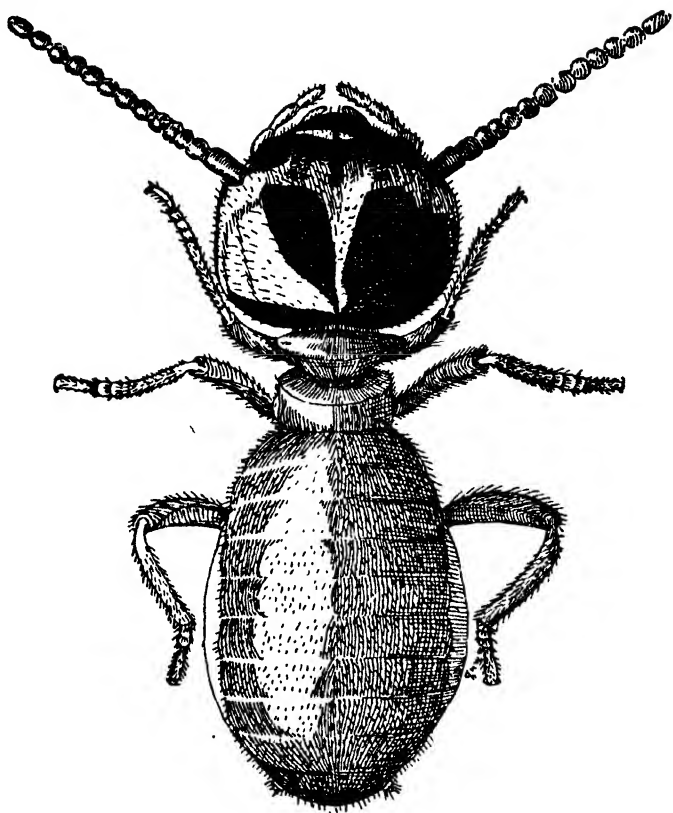
Applied Control: The nests may be destroyed with a cutlass, or their inhabitants killed by placing a tablespoonful of Paris green or white arsenic in the top of the nest, or in the main tunnels if the nest can not be easily localized.

Host: The following trees have been recorded as affected by this insect in Puerto Rico:

<i>Agati grandiflora</i> (L.) Desv.	"gallito"
<i>Albizia lebeck</i> (L.) Benth.	"amor platónico"
<i>Albizia procera</i> (Willd.) Benth.	"albizia"
<i>Alchornea latifolia</i> Sw.	"achiotillo"
<i>Anacardium occidentale</i> L.	"pajuil"
<i>Andira jamaicensis</i> (W. Wright) Urban	"moca"
<i>Artocarpus communis</i> Forst.	"palo de pan"
<i>Avicennia nitida</i> Jacq. .	"chifle de vaca"
<i>Bixa orellana</i> L.	"achiote"
<i>Bucida buceras</i> L.	"úcar"
<i>Buchenavia capitata</i> (Vahl) Eichl.	"granadillo"
<i>Bursera simarouba</i> (L.) Sarg.	"almácigo"
<i>Catophyllum calaba</i> Jacq.	"maría"
<i>Canarium odoratum</i> (Lam.) King	"ilanilán"
<i>Capparis portoricensis</i> Urban	"burro blanco"
<i>Casearia decandra</i> Jacq.	"gía mansa"
<i>Casuarina equisetifolia</i> Forst.	"casuarina"
<i>Cecropia pellata</i> L.	"yagrumo hembra"
<i>Cedrela odorata</i> L.	"cedro español"
<i>Ceiba pentandra</i> (L.) Gaertn.	"ceiba"
<i>Clusia rosea</i> Jacq.	"cupey"
<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"
<i>Cocos nucifera</i> L.	"coco"
<i>Colubrina arborescens</i> (Mill.) Sarg.	"abeyuelo"

PLATE I

Nasutitermes (N.) *costalis* (Holmgren), worker 20X (Drawing by G. N. Wolcott)
Nasutitermes (N.) *costalis* (Holmgren), soldier 20X (Drawing by G. N. Wolcott)



(Luis F. Martorell: A Survey of the Forest Insects of Puerto Rico)

<i>Conocarpus erectus</i> L.	"botoncillo"
<i>Cordia nitida</i> Vahl	"cereza"
<i>Cordia sulcata</i> DC.	"moral"
<i>Crescentia cujete</i> L.	"higüera"
<i>Dacryodes excelsa</i> Vahl	"tabonuco"
<i>Dalbergia ecastophyllum</i> (L.) Taub.	"palo de pollo"
<i>Dalbergia sissoo</i> Roxb.	"siso"
<i>Delonix regia</i> (Bojer) Raf.	"flamboyán"
<i>Didymopanax morototoni</i> (Aubl.) Dene. & Pl.	"yagrumo macho"
<i>Elaeodendrum xylocarpum</i> (Vent.) DC.	"coscorrón"
<i>Erythrina glauca</i> Willd.	"bucare"
<i>Eucalyptus robusta</i> Smith	"eucalipto"
<i>Eugenia jambos</i> L.	"pomarroza"
<i>Eugenia monticola</i> (Sw.) DC.	"biriji"
<i>Euterpe globosa</i> Gaertn.	"palma de sierra"
<i>Ficus elastica</i> Roxb.	"palo de goma"
<i>Ficus laevigata</i> Vahl	"jaguey"
<i>Ficus lyrata</i> Warb.	"palo de goma"
<i>Ficus stahlia</i> Warb.	"jagüey"
<i>Genipa americana</i> L.	"jagüa"
<i>Gilibertia arborea</i> (L.) E. March	"palo de cachimba"
<i>Guarea trichilioides</i> L.	"guaragua"
<i>Guazuma ulmifolia</i> Lam.	"guácima"
<i>Haematoxylon campechianum</i> L.	"campeche"
<i>Hernandia sonora</i> L.	"mago"
<i>Hura crepitans</i> L.	"javello"
<i>Hyeronima clusioides</i> (Tul.) Griseb.	"cedro macho"
<i>Hymenaea courbaril</i> L.	"algarrobo"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Krugiodendron ferreum</i> (Vahl) Urban	"palo de hierro"
<i>Laguncularia racemosa</i> (L.) Gaertn.	"mangle bobo"
<i>Leucaena glauca</i> Benth.	"acacia pálida"
<i>Lonchocarpus glaucifolius</i> Urban	"geno"
<i>Lonchocarpus latifolius</i> (Willd.) H.B.K.	"hediondo"
<i>Lucuma multiflora</i> A. DC.	"jácana"
<i>Mammea americana</i> L.	"mamey"
<i>Mangifera indica</i> L.	"mangó"
<i>Manilkara pleyana</i> (Pierre) Cronquist	"mameyuelo"
<i>Melicocca bijuga</i> L.	"quenepa"
<i>Metopium brownei</i> (L.) Krug & Urban	"papayo"
<i>Moringa oleifera</i> Lam.	"ben"

<i>Nectandra sintenisii</i> Mez	"laurel amarillo"
<i>Ochroma lagopus</i> Sw.	"guano"
<i>Persea gratissima</i> Gaertn	"aguacate"
<i>Petitia domingensis</i> Jacq.	"capá blanco"
<i>Piper aduncum</i> L.	"higuillo"
<i>Pisonia albida</i> (Heimmerl.) Britton	"corcho"
<i>Pisonia subcordata</i> Sw.	"corcho"
<i>Pithecellobium arboreum</i> (L.) Urban	"cojóbana"
<i>Pithecellobium dulce</i> (Roxb.) Benth.	"guamá americano"
<i>Pithecellobium unguis-cati</i> (L.) Mart.	"rolón"
<i>Prosopis juliflora</i> (Sw.) DC.	"bayahonda"
<i>Pterocarpus indicus</i> Willd.	
<i>Quararibaea turbinata</i> (Sw.) Poir.	"garrocho"
<i>Randia aculeata</i> L.	"escambrón"
<i>Rapanea ferruginea</i> (R. & P.) Mez.	"mantequero"
<i>Rhizophora mangle</i> L.	"mangle colorado"
<i>Roystonea borinquena</i> Cook	"palma real"
<i>Sabinea florida</i> (Vahl) DC.	"retama"
<i>Sapium laurocerasus</i> Desf.	"manzanillo"
<i>Sciacassia siamea</i> (Lam.) Britton	"cassia amarilla"
<i>Sideroxylon foetidissimum</i> Jacq.	"tortugo amarillo"
<i>Spondias cirouella</i> Tussac.	"ciruela"
<i>Spondias dulcis</i> Forst.	"cítara"
<i>Spondias mombin</i> L.	"jobo"
<i>Sterculia apetala</i> (Jacq.) Karst.	"anacagüitas"
<i>Swietenia mahagoni</i> Jacq.	"caoba"
<i>Tabebuia heterophylla</i> (DC.) Britton	"roble prieto"
<i>Tabebuia pallida</i> Miers	"roble"
<i>Tamarindus indicus</i> L.	"tamarindo"
<i>Terminalia catappa</i> L.	"almendra"
<i>Tetragastris balsamifera</i> (Sw.) Kuntze	"masa"
<i>Thrinax microcarpa</i> Sarg.	"palma de escoba"
<i>Torrubia fragans</i> (Dum.-Cours.) Standley	"corcho prieto"
<i>Trema lamarckiana</i> (R. & S.) Blume	"cabrilla"
<i>Trichilia hirta</i> L.	"cabo de hacha"
<i>Trichilia pallida</i> Sw.	"caracolillo"
<i>Vachellia farnesiana</i> (L.) Wight & Arn.	"aroma"
<i>Vitex divaricata</i> Sw.	"higüerillo"
<i>Zanthoxylum caribaeum</i> Lam.	"espino rubial"
<i>Zanthoxylum martinicense</i> (Lam.) DC.	"cenizo"
<i>Zanthoxylum monophyllum</i> (Lam.)	"mapurito"

CORRODENTIA

The insects belonging to this group should be mentioned due to the fact that the trunk and branches of trees sometimes are covered by a very fine silken web, produced by these insects. This might give the erroneous impression that the tree has been attacked by a terrible pest or invasion of caterpillars or any other injurious insect. On removing carefully the web or silken covering, small aphid-like insects, running very fast over the bark, winged and wingless forms present, will be observed. These are the so called, dust-lice, bark-lice, book-lice or psocids.

The exact role of these insects in nature is not exactly known. It has been said that some species are predaceous on scale insects, others feeding upon insect eggs and even small aphids. Possibly some act as scavengers.

The most common species in Puerto Rico, which is often found on trees is ***Pseudocaecilius pretiosus*** (Banks). This species is perhaps the most abundant and is simply recognized by the white, silken web which sometimes covers the entire trunk and even branches of trees.

It would be a most interesting investigation, to study the life history of these insects so as to define exactly their economic importance if any.

THYSANOPTERA

The minute, almost inconspicuous insects included in this group are the so called thrips. They are very abundant everywhere on trees, shrubs and plants. The thrips are phytophagous as well as predaceous in their habits. Some species are very injurious to vegetation, others feed exclusively upon insects, even to the point as to prey on members of its same group. *Aleurodothrips fasciapennis* (Franklin) one of our insular species, feeds on the citrus white fly, *Dialeurodes citri* Ashmead in Florida, and on the scale insect, *Aspidiotus destructor* Signoret, in other parts of the world. Only few species in our insular fauna are injurious to trees. The most important species are :

Heliothrips haemorrhoidalis (Bouché)

(Greenhouse Thrips)

This insect which is popularly known as the greenhouse thrips is fairly common in Puerto Rico.

Adult : The adult is dark brown in color with light-colored appendages, its size ranging from $\frac{1}{8}$ to $\frac{1}{4}$ of an inch. The antennae are 8-segmented.

Larva : The larva of this species on maturity is yellowish and the abdomen for the most part is covered with small, wartlike elevations. Most of the hairs of the body except at the tip of the abdomen, are knobbed.

The apical abdominal segments are somewhat tubular. These apical segments are usually slightly stained on the sides with brown. (Franklin, 1908, p. 719.)

Habits: The nymphs and adults suck the plant juices, feeding especially on the foliage of the host trees or plants. When these insects become abundant they are capable of producing an intense chlorosis in the leaves of the plants attacked.

Host: Recorded from *Barringtonia speciosa* Forst. Extent of damage unknown, presumably not a serious pest on this tree.

Selenothrips rubrocinctus (Giard)

(Cacao Thrips)

This is perhaps the most common and injurious species of thrips in the Island, attacking a large variety of plants, shrubs and trees. The common name of this insect is the cacao thrips, on account of its ravages on the cacao plantations in some of the West Indian islands. The species was originally described by Giard (1901, p. 263-5) as *Physopus rubrocincta* from specimens collected on cacao leaves at the island of Guadaloupe, French West Indies.

The insect was re-described by Franklin (1908, p. 719-723). The form which one usually sees attacking the foliage of host trees is the nymph and usually all stages are observed crawling on the undersides of the leaves.

"Larva: At least in their latter stages the larva is bright yellow with a wide bright red hypodermal pigment band running across the base of the abdomen on the upper-side and with the abdomen tipped with bright red on account of the hypodermal pigment. The posterior corner of some of the intervening segments are also often touched slightly with red. Head also usually irregularly mottled more or less, especially about the eyes with reddish or orange pigment. (See illustration in IB, p. 66.)

"Mature nymph: Length, about 0.92 mm.; width of thorax, about 0.27 mm.; greatest width of abdomen, about 0.37 mm. Colored in general like the adult insect but lighter as a rule, especially the abdomen; the band of red pigment at the base of the abdomen is quite noticeable. Shape more chunky than that of the adult, the segments of the body being drawn closely together. Wings rather darker than in adult. Red pigment at apex of abdomen conspicuous. The wing pads reach to about the seventh segment." (Franklin 1908).

Type of injury: When the insect becomes abundant it causes a very heavy chlorosis on the leaves, which makes these turn light brownish or whitish, sometimes giving a silvery appearance to the foliage. This is

especially noticeable on trees of "almendra", *Terminalia catappa* L. when they suffer from a heavy infestation. After such an attack usually a shedding of leaves takes place.

Natural Enemies: The eulophid wasp, *Dasyscapus parvipennis* Gahan which is parasitic on thrips, was imported into Puerto Rico from the Gold Coast (Africa) and after thousands of parasites were released, none have been recovered yet.

Applied control: If it is necessary to control the thrips, soap sprays, Black Leaf-40 or some of the new insecticides in the market having derris or pyrethrum as a basis can be effectively used.

Host: The following trees are attacked in Puerto Rico by this species of thrips:

<i>Anacardium occidentale</i> L.	"pajuil"
<i>Bixa orellana</i> L.	"achiote"
<i>Chrysobalanus icaco</i> L.	"icaco"
<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Mangifera indica</i> L.	"mango"
<i>Psidium guajava</i> L.	"guayaba"
<i>Spondias mombin</i> L.	"jobo"
<i>Terminalia catappa</i> L.	"almendra"
<i>Zanthoxylum monophyllum</i> Lam.	"espino rubial"

Gynaikothrips ficorum (Marchal)

(The Ficus Thrips)

This species is very common in Puerto Rico and has also been recorded from Florida, Cuba, Canary Islands, Algeria (Africa) and Java. They were first described from specimens collected at Algiers, affecting the trees in the avenues of that city, especially the species *Ficus laevigata* and *Ficus nitida*. The thrips were originally described under the name of *Phloethrips ficorum* by Dr. Marchal (1908, p. 251-3). The previous Puerto Rican records under the name *G. uzeli* Zimmerman should be placed under the new adopted name *ficorum* (Marchal).

Adult: The adults are black, from 2.5 to 3 mm. in length and the entire body surface including the femora and tibiae conspicuously reticulated.

Habits: The insect becomes especially abundant when the host trees are beginning to develop new shoots and leaves. They reproduce in such tremendous numbers that many trees are attacked at the same time. The young and tender leaves are curled by the effect of the infestation and after several days they look brownish, as if burned. Most of the tender foliage is killed. On trying to open one of these curled leaves, one may find the insides full of minute immature stages and even smaller eggs of the thrips,

Not only these thrips do damage to the trees attacked, but they become so abundant as to be falling constantly in the eyes of by-passers. When one of these minute insects comes in touch with the eye, a burning, very disagreeable sensation is produced, causing the subsequent irritation of the mucuous membranes of the eyes. People going to "plazas" or squares of towns where these host trees are used as shade and ornamental trees, are bothered by these insects.

The thrips attack the host trees at lower elevations as well as middle altitudes. The writer has observed trees at about 1,400 ft. with intense infestations, produced by this insect.

Natural Enemies: The thrips are attacked by hemipterous insects belonging to the Family Anthocoridae. The following species have been recorded as predators of this thrips: *Cardiastethus rugicollis* Champion and *Macrotrachelielia nigra* Parshley; also *M. laevis* Champion. The tetrastichid wasp, *Tetrastichus tatei* Dozier has been listed as a parasite of the thrips.

Host: The chief host of this species of thrips in Puerto Rico is the common "laurel de la India", *Ficus nitida* Thunb., used as an ornamental and shade tree in gardens and "plazas".

HOMOPTERA

FAMILY MEMBRACIDÆ

The insects belonging to this family are the so called tree-hoppers or membracids. Although the Puerto Rican species are not known to be of economic importance from the standpoint of being injurious to trees, nevertheless they are so abundant and commonly observed on trees, that they are worthy of mention.

In general, the food of tree-hoppers consists of plant juices, but never become sufficiently abundant as to cause severe damages. The female usually lays the eggs under the bark of smaller branches and in buds or stems. Some species cause injury to the trees during the egg-laying process.

The most common species on our Island are the following:

Nessorhinus gibberulus Stål

Nessorhinus vulpes Amyot & Serville

Monobelus fasciatus (Fabricius)

Nessorhinus gibberulus Stål has been recorded from the following trees: "guaba", *Inga vera* Willd., "pomarrosa", *Eugenia jambos* L., and "jobo", *Spondias mombin* L. (see illustration in IB, p. 73.)

Nessorhinus vulpes Amyot & Serville, has been recorded from the following trees: "icaco" *Chrysobalanus icaco* L., "maga" *Montezuma*

speciosissima Sessé & Moc., and "guayaba", *Psidium guajava* L. (see illustration in IB, p. 74.)

Monobelus fasciatus (Fabricius) is a common West Indian species and undoubtedly our most common tree-hopper. It has been recorded from the following trees:

<i>Cestrum diurnum</i> L.	"dama de día"
<i>Erythrina glauca</i> Willd.	"bucare"
<i>Ficus sintenisii</i> Warb.	"jagüey"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Spondias mombin</i> L.	"jobo"
<i>Terminalia catappa</i> L.	"almendra"

FAMILY CERCOPIIDÆ

The insects included in this family are commonly known as spittle-insects or frog-hoppers. The common name, spittle-insect, originated from one of the peculiar habits of these insects. The immature stages are passed in a midst of a white froth, very similar to a spittle. Years ago it was called frog-spittle, and the popular belief was that frogs were responsible for such spittles on trees.

Some species of frog-hoppers are very injurious to vegetation. Our tree forms so far known do not cause any appreciable injury.

The most common species on trees are: ***Epicranion championi*** Fowler and ***Philaenus fusco-varius*** Stål. Mr. P. W. Oman of the U. S. National Museum, believes that all the previous records under *E. championi* Fowler should be under a different name, because *championi* is a Central American form, presumably not present in our Island.

Epicranion championi Fowler which is a very common insect on coffee, has also been recorded from "jagüey", *Ficus stahlia* Warb. and "guamá", *Inga laurina* (Sw.) Willd.

Philaenus fusco-varius Stål is more abundant than the preceeding species. It has been recorded from "guaba", *Inga vera* Willd., "guamá", *Inga laurina* (Sw.) Willd., "pomarroza", *Eugenia jambos* L., and "guayaba" *Psidium guajava* L.

FAMILY CICADELLIDÆ

The members of this family known as "leafhoppers", are insects of great economic importance as far as agricultural crops are concerned. Some species affect our trees, many of them being quite harmful. These insects are phytophagous in their habits and obtain their food by sucking the juices of plants, especially from their foliage. When they become abund-

ant they can cause intense chlorosis of the trees attacked, the leaves either turning yellowish or brownish followed by a partial defoliation in most cases. The life history of our forest species has not been studied yet, but the nature of the damage as well as the host trees of most species have been recorded. The following species are injurious to trees in Puerto Rico.

Agallia albidula Uhler, is a species recorded as causing considerable defoliation on "gallito" trees, *Agati grandiflora* (L.) Desv. (illustration in IB, p. 76.)

Protalebra cordiae Osborn, the "capá prieto" leaf-hopper is a species abundant on "capá prieto" trees, *Cordia alliodora* (R. & P.) Cham. Sometimes it becomes so abundant as to be the cause of intense chlorosis in the foliage by a subsequent defoliation. The leafhopper attacks the trees in the lowlands as well as those at middle elevations up to the 2,000 ft. mark. It is most abundant during the dry seasons of the year, when it causes its maximum injury. The species was described by Dr. H. Osborn from *Cordia* sp. collected at Aguirre. The specific name of the tree is not given in the description. The writer believes it was *Cordia nitida* Vahl, a common tree in the vicinity of Aguirre, found along roadsides and pastures. (Illustration of species in Osborn 1935, p. 179).

Protalebra tabebuiae Dozier, the common "roble" leafhopper is found in great numbers among the foliage of "roble" trees, *Tabebuia pallida* Miers. Like the preceding species this insect is capable of producing intense chlorosis and defoliation in infested trees. The species is very abundant in the lowlands and has been also recorded at 900 ft. in altitude. It has also been listed on "almendra" *Terminalia catappa* L., presumably just resting there and not feeding on the foliage.

Empoasca fabalis DeLong, is a fairly common species in Puerto Rico. It has been recorded on "gallito", *Agati grandiflora* (L.) Desv., causing yellowing of leaves and defoliation. All stages were found abundantly on the foliage of the host tree.

Empoasca sexmaculata DeLong has been recorded from "esmajagua", *Pariti tiliaceum* (L.) Hil., causing yellowing of the foliage on trees at Punta de Cangrejos, near Santurce. All stages were found abundantly on the undersides of the leaves.

Empoasca minuenda Ball is one of the most common species in the genus. It has been recorded from "anona blanca", *Annona diversifolia* Safford, "maga", *Montezuma speciosissima* Sessé & Moc., and "aguacate" *Persea gratissima* Gaertn.

Dikraneura cedrelae Oman, our common "cedar leafhopper" is possibly the most injurious forest species. The insect attacks the foliage of cedars,

Cedrela odorata L. and *Cedrela mexicana* Roem., in the lowlands as well as at middle elevations up to 2,000 ft. It is more abundant during dry spells of the year, causing intense chlorosis of the foliage and heavy defoliation. When abundant, hundreds of trees are attacked at the same time in certain section of the Island. The leafhopper is controlled in the field by the fungus, *Hirsutella verticilloides*.

Hybla maculata McAtee has been recorded from "mamey", *Mammea americana* L., and "esmajagua", *Pariti tiliacum* (L.) Hil. On *Pariti* the insect is often very abundant causing yellowing of the leaves as the writer has been able to observe at Cayey (altitude 1,000 ft.) and in Mona Is., at sea-level. At Mona many trees were heavily infested by this species.

The insect species just mentioned are the most important as far as economic importance is concerned in relation to forest, shade and ornamental trees in our Island. As the different species of leafhoppers are so similar in their general appearance, no attempt has been made to give a description of each species. However, if the reader is interested in knowing more about this group of insects, reference should be made to Osborn's publication on the Homoptera of Puerto Rico. (Osborn, 1935).

FAMILY FULGORIDÆ

This family includes a group of insects which depend exclusively upon plant juices for their existence. We have some species in the Island but none of them are injurious to trees as far as we know. Since they are commonly seen on trees, even breeding on twigs and on the undersides of the leaves, it is worthwhile to mention the most common species as well as the host trees of which they have been recorded.

Bothriocera venosa Fowler is a common species in Puerto Rico. It has been recorded from the following trees: "uva de playa", *Coccolobis wifera* (L.) Jacq., "guaba", *Inga vera* Willd. and "guamá", *Inga laurina* (Sw.) Willd. (See illustration on IB, p. 94.)

Ormenis pygmaea (Fabricius) is one of our most common species of fulgorids in Puerto Rico. They are usually present on the twigs or under the leaves of trees, breeding sometimes abundantly. (See illustration in IB, p. 103.) The species has been recorded from the following trees:

<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"
<i>Eugenia jambos</i> L.	"pomarroza"
<i>Piper amalago</i> L.	"higuillo de limón"
<i>Torrubia fragans</i> (Dum.-Cours.) Standley	"corcho prieto"

<i>Varronia angustifolia</i> West	"basora"
<i>Varronia corymbosa</i> (L.) Desv.	"saragüazo"
<i>Zanthoxylum monophyllum</i> Lam.	"espino rubial"

Ormenis marginata (Brunnich) is perhaps our most abundant fulgorid in Puerto Rico. It occurs in almost the same situations as *O. pygmaea* (Fabr.) and often both species are seen together on the same twigs or leaves. All these species of fulgorids are very fond of the semi-darkness of the forest or shrubs, not liking those trees which are more or less exposed to the direct sunlight. The writer has been able to observe twigs and leaves of many different trees fully infested by this species, yet no appreciable injury was noticed. The species has been recorded from the following trees:

<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Coccolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Inga vera</i> Willd.	"guaba"
<i>Nectandra sintenisii</i> Mez	"laurel macho"
<i>Ocotea portoricensis</i> Mez	"laurel"
<i>Petitia domingensis</i> Jacq.	"capá blanco"
<i>Terminalia catappa</i> L.	"almendra"
<i>Torrubia fragans</i> (Dum.-Cours.) Standley	"coreho prieto"

Ormensis quadripunctata (Fabricius) is another common species very abundant on trees. It is quite different from the two preceding species, being blue gray in color and with distinguishing dark dots on the elytra. (See illustration in Osborn, 1935 p. 221.) It has been recorded from the following trees:

<i>Chrysobalanus icaco</i> L.	"icaco"
<i>Citharexylum fruticosum</i> L.	"péndula"
<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Coccolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Erythrina glauca</i> Willd.	"bucare"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Varronia corymbosa</i> (L.) Desv.	"saragüazo"

FAMILY CHERMIDÆ

The jumping plant lice or psyllids are the common names applied to the members of this family. These insects are very similar in appearance to the aphids, but can be distinguished from them by their stouter legs, the hind pair fitted for jumping, the firmer texture of the body and the ten-jointed antennae, very seldom nine or eleven-jointed. They live and breed on the foliage of trees and some species become so abundant as to

be the cause of partial defoliation. In general they are not injurious insects and more or less can be compared with our white flies in this respect. The species attacking trees in the Island are the following:

Heteropsylla mimosae Crawford, which also occurs in Texas is a light orange to reddish brown species not abundant in the Island. (Described by Crawford, 1914, p. 48).

Host: Recorded only from "aroma" *Vachellia farnesiana* (L.) Wight & Arn.

Heteropsylla puertoricensis Caldwell is another species, although not common. The head and thorax is yellow and the abdomen greenish in the females. (Caldwell 1942, p. 28.)

Host: Only recorded from the foliage of "samán", *Samanca saman* (Jacq.) Merrill.

Ceropsylla sideroxyli Riley is perhaps our most abundant lowland species. The adult is greenish yellow on the upper side, abdomen and venter green: the praescutum brownish on the anterior half or two-thirds, the head with a black area between the antennae, extending up around front ocellus and including genal cones. The antennae are brown, greenish on the basal half. (Crawford 1914, p. 101.)

Habits: The immature form of this species causes a pit or cup-shaped excavation on the leaves of the host trees, which is very characteristic of the species. A wax-like secretion covers the dorsal surface of the larva and on looking to infested leaves, one can only see pits full of whitish powder. When these insects become abundant they cause partial defoliation of the host trees.

Host: Recorded from "tortugo amarillo", *Sideroxylon foetidissimum* Jacq. in Puerto Rico. Also from same host tree at Florida, from which the species was originally described.

Ceropsylla martorelli Caldwell, is abundant in our mountain forests at middle and higher elevations. The following are the main characteristics of the species:

"General color of the male, red to light orange, the female light to dark brown. The head as broad as thorax, scarcely deflexed. Eyes very prominent. Genal cones three-fourths as long as vertex, continuous throughout; apices acute. Antennae one and one-fourth times as long as width of head" (Caldwell 1942, p. 28-9.)

Habits: The eggs of this insect presumably are laid on shoots or very tender foliage of the host trees. The adults are commonly seen during the rainy seasons of the year, when new shoots are appearing on the trees. Otherwise, one can only see the immature forms during the rest of the year.

The immature forms or larvae of the psyllid, are the cause of certain

small pits or cup-shaped excavations about one-fourth or one-fifth the size of those caused by the related species *C. sideroxyli* Riley. These excavations open to the undersides of the leaves and are very close one to the other, sometimes as many as a hundred or more are observed on a leaf. Looking at the leaves from the upper surface it gives the false appearance of galls. The young larvae are covered by a whitish bloom, not so noticeable as that of *C. sideroxyli* Riley.

The writer has not been able yet to observe this insect in the lowlands, apparently it is a middle and higher altitude species where most of its host trees grow.

Host: The following trees are infested by this psyllid in Puerto Rico:

Ocotea leucoxylon (Sw.) Mez "laurel geo"

Ocotea portoricensis Mez "laurel"

Euphalerus nidifex Schwarz is present where its host tree is growing, usually along the coast. The species is not very abundant due to the scarcity of its host tree. The chief characteristics of the species are as follows:

The general color is greenish white, speckled with brown or black spots over the entire surface, including wings and legs; antennae tipped with black on each segment; wings maculated apically and covered over the entire surface with dots. The vertex and pronotum very finely punctate or smooth, eyes scarcely recessive; genal cones one-half to five-sixths as long as vertex. (Crawford, 1914, p. 119.)

Habits: This species is one of the nest making psyllids, of which only few are known to science.

"The species from Key West (Florida) forms a nest-like globular structure of whitish color, usually along the midribs of the fully developed leaves. Upon examination the walls of this structure is seen to be composed of fine, cotton-like threads. When inhabited by the larvae the nests are of a sticky nature, but old specimens become brittle in time. They are fastened to the leaves by a broad base so that the larva, in feeding, is forced to push its beak through this space into the parenchyma of the leaf." (Proc. Ent. Soc. of Wash. vol. 6, 1904, p. 153-154.)

Host: The insect breeds on the foliage of "ventura", *Piscidia piscipula* (L.) Sarg. It has been previously recorded from the same host in Florida and Cuba. There is a record of one female from British Honduras.

Arytaina cayeyensis Caldwell is a recently described species and nothing so far is known about its habits. The general characteristics of the species are as follows:

"General color straw yellow over all with indications of broad white stripes on the thorax; five terminal antennal segments black.

"Head rather declivious, finely pubescent, as broad as thorax. Vertex twice as broad as long, somewhat rounding downward in front. Posterior ocelli strongly elevated. Genal cones half as long as vertex, divergent, broadly rounded. Antennae almost two and one half times as long as width of head." (Caldwell 1942, p. 29-30.)

Host: Recorded from *Inga* sp., collected by Dr. H. Osborn at Cayey, P. R., Jan. 28, 1929.

Psylla minuticon Crawford is our most common species, particularly abundant at middle altitudes, where the host trees are seen in coffee groves. The general characteristics of this species are:

"General color greenish yellow to light orange; antennae flavous on basal half, rest black." (Crawford 1914, p. 159.)

This species resembles *P. torrida* Crawford described from Para, Brazil. In referring to some specimens which Dr. J. Caldwell identified for the writer some years ago, he says in a personal letter the following:

"The longer I look at the specimens of *minuticon* from Puerto Rico the more I think they are not *minuticon*. I have specimens from El Salvador and Mexico that fit the description much better. The Puerto Rico specimens do not have anything that can be called a crotch-shaped structure between the forceps, and the head is flat not rounded down as in *Calophya*. As you will note, everything is compared with *torrida* and it may be the true *minuticon*. I will try to send some specimens to Hawaii for comparison. Meanwhile I am sorry I ever put a label on our so called *minuticon*."

Host: The psyllid affects the leaves of "guaba", *Inga vera* Willd., especially abundant on the young tender foliage. Also recorded from Guatemala, El Salvador and Mexico, but no host plants or trees are mentioned.

Psyllia martorelli Caldwell has been found living under the same situation as *Psylla minuticon* Crawford. The species was collected while breeding in the young and tender shoots of "guaba" trees, at the mountains north of Villalba, about 1,200 feet in altitude.

The species is described as follows:

"Length 2.5-3.5 mm., forewing 2-2.5 mm. Specimens in preservative color unknown. Mesoscutum with broad light stripes.

"Head broader than thorax; eyes somewhat stalked; posterior ocelli greatly elevated. Vertex scarcely deflexed, rolled somewhat roundedly forward. Genae scarcely swollen; frons much sunken but not covered by genae. Antennae almost as long as entire insect. Thorax scarcely arched. Forewings little over twice as long as broad; apical margins almost flat; pterostigma not apparent; costal margins pubescent.

"Apices of male forceps slightly bifurcate. Female genital segment as long as rest of abdomen; both valves very slender, stylate in apical half." (Caldwell, J. S., Dec. 1944, p. 339.)

Nothing is known yet about the biology of this insect.

Host: Breeding on the tender growth of "guaba", *Inga vera* Willd.

FAMILY APHIIDÆ

This family includes a group of soft bodied insects having a complex system of reproduction and very interesting life histories, commonly known as aphids or "pulgonces". Some species are very injurious to important crops, like sugar cane, cucumbers, melons, beans, cotton, etc. The Puerto Rican species are not really of economic importance as far as trees are concerned. Some species attack some of our trees but they rarely become sufficiently abundant to be considered as pests. Our insular forms which affect trees are the following:

Aphis gossypii Glover is a fairly common species in the Island, doing considerable damage to crops of economic value like cotton, cucumbers, melons, etc. The chief characteristics of the species as described by Gillette and Palmer, 1932, p. 400 are as follows:

"Color.--Viviparae. Pale yellow to pale sordid or yellowish green to mottled blackish-green without dusky markings, except on lateral areas; legs pale; cornicles black; nymphs of alatae green with dorsum of abdomen flesh color, powdered on head and thorax and usually tessellated on abdomen" (for more descriptive characters see Gillette & Palmer 1932, p. 400) (see fig. 2).

Natural Enemies: The aphids reproduce in alarming numbers in the field, but they are also likewise controlled by a group of parasites and predators which under normal conditions keep them on check. The following are some of the insect enemies of aphids:

The coccinellid beetles: *Cryptolaemus montrouzieri* Mulsant, *Cycloneda sanguinea* Linnaeus, *Diomus roseicollis* Mulsant, *Hippodamia convergens* (Guerin), *Hiperaspis festiva* Mulsant, *Hyperaspis connectens* (Thunb.), *Psyllobora nana* Mulsant, *Scymnus loewi* Mulsant and *Scymnus* sp. (see Fife, 1939.)

The syrphid fly larvae, *Baccha clavata* (Fabricius) and *Baccha latiusculus* (Loew) prey upon this species of aphid and are one of their most efficient means of control.

The larva of *Chrysopa* sp. (Chrysopidae: Neuroptera) also attacks the aphid.

On the parasitic group the most important species is the braconid

wasp, *Aphidius testaceipes* (Cresson). This parasite is very abundant in the field and very efficient in its control.

The insect is also attacked by the fungus *Acrostalagamus aphidum* Oud., becoming at times abundant in the field and destroying large numbers of aphids.

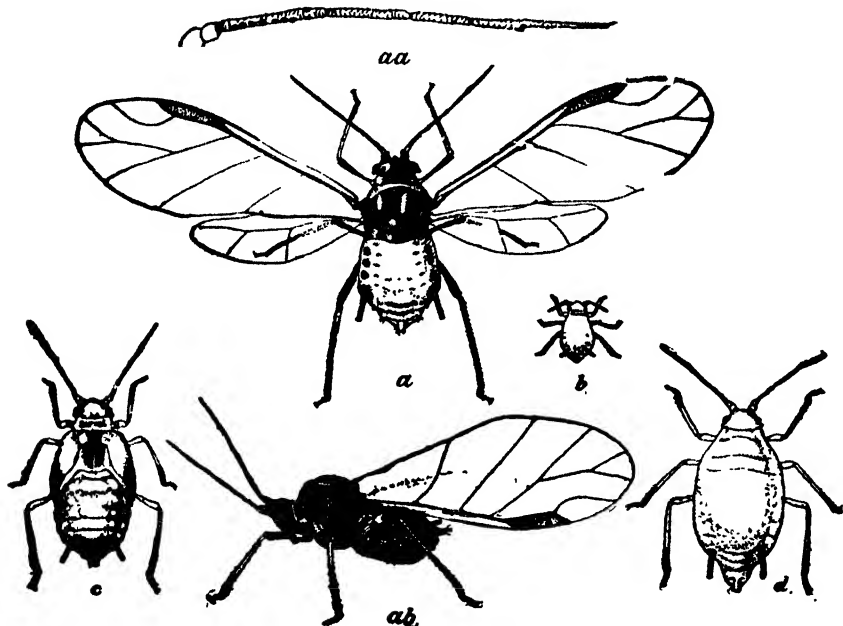


FIG. 2. *Aphis gossypii* Glover: a. winged female; aa. antenna of same greatly enlarged; ab. dark female from the side; b. small nymph; c. fully grown nymph; d. wingless female. (After Chittenden.)

Host: The following trees are attacked by the aphid:

<i>Cecropia peltata</i> L.	"yagrumo"
<i>Mangifera indica</i> L.	"mango"
<i>Psidium guajava</i> L.	"guayaba"
<i>Tabebuia pallida</i> Miers	"roble"
<i>Terminalia catappa</i> L.	"almendra"

Aphis nerii Fonscolombe is a very conspicuous and easily recognizable species due to its large size and bright yellow color. Undoubtedly is the largest species of aphid in the Island.

Color:—Viviparae. Large yellow aphid with black antennae and legs.

Habits: Usually on the undersides of leaves, but when abundant, found in all places even on the twigs. The insect is a typical low altitude form,

not seen at middle elevations. Fairly common in the drier as well as moist sections of the Island, usually on different host plants in each section.

Natural Enemies: In the field these aphids are naturally controlled by syrphid fly larvae. Three species of flies all in the same genus have been recorded as feeding on this aphid: *Baccha clavata* (Fabricius), *B. fasciatus* Roeder and *B. latiusculus* Loew.

Host: In the dry sections of the Island it attacks the foliage of the giant milkweed or "algodón de seda", *Calotropis procera* (Ait.) R. Br.

Aphis rumicis Linnaeus is another of our species, although not very common. The chief characteristics of the species are:

"Color.—Viviparae. Dark olive-green to black, cauda and cornicles black; legs and antennae mostly pale. Nymphs of alatae blackish except meso- and meta-thorax which are pale green; abdomen tessellated with 4 rows of powdery spots on dorsum." (Gillete & Palmer 1932, p. 439.)

Habits: Like nearly every aphid the insects are usually found on the undersurface of the leaves. They rarely become abundant enough to cause injury of economic importance.

Host: Recorded from the foliage of "uva*de playa", *Coccolobis uvifera* (L.) Jacq.

Toxoptera aurantii (Fonscolombe), is perhaps our most common species attacking trees and shrubs. It has been recorded in the lowlands as well as middle altitudes up to 2,000 ft. The main characteristics of the species are:

Apterous females: The apterous females are dark brown, nearly black; margin of abdomen not bearing tuberculate hairs. The sixth antennal segment of winged female equal to one-sixth the terminal filament; wing veins and stigma fuscous; fork of cubital vein arising before the point where the stigmal vein originates. (Phillips & Davis 1912, p. 8.)

Habits: The aphids are usually found on the undersides of the leaves, but sometimes they attack the young shoots of the plants. When abundant they cause curling of the leaves.

Natural Enemies: The insect is controlled by the larvae of syrphid flies, *Baccha clavata* (Fabricius), *B. fasciatus* Roeder and *B. latiusculus* (Loew). The larva of the coccinellid *Psorolyma maxillosa* Sicard is also an enemy of this insect.

Perhaps the most efficient parasite contributing in the natural control of this aphid is the braconid wasp, *Aphidius testaceipes* (Cresson).

The fungus *Acrostalagmus aphidum* Oud. when abundant in the fields controls the aphids efficiently.

The most common among the predators is the larva of the blue-black syrphid fly *Bacca clavata* (Fabricius) (see fig. 3.) The larvae are legless,

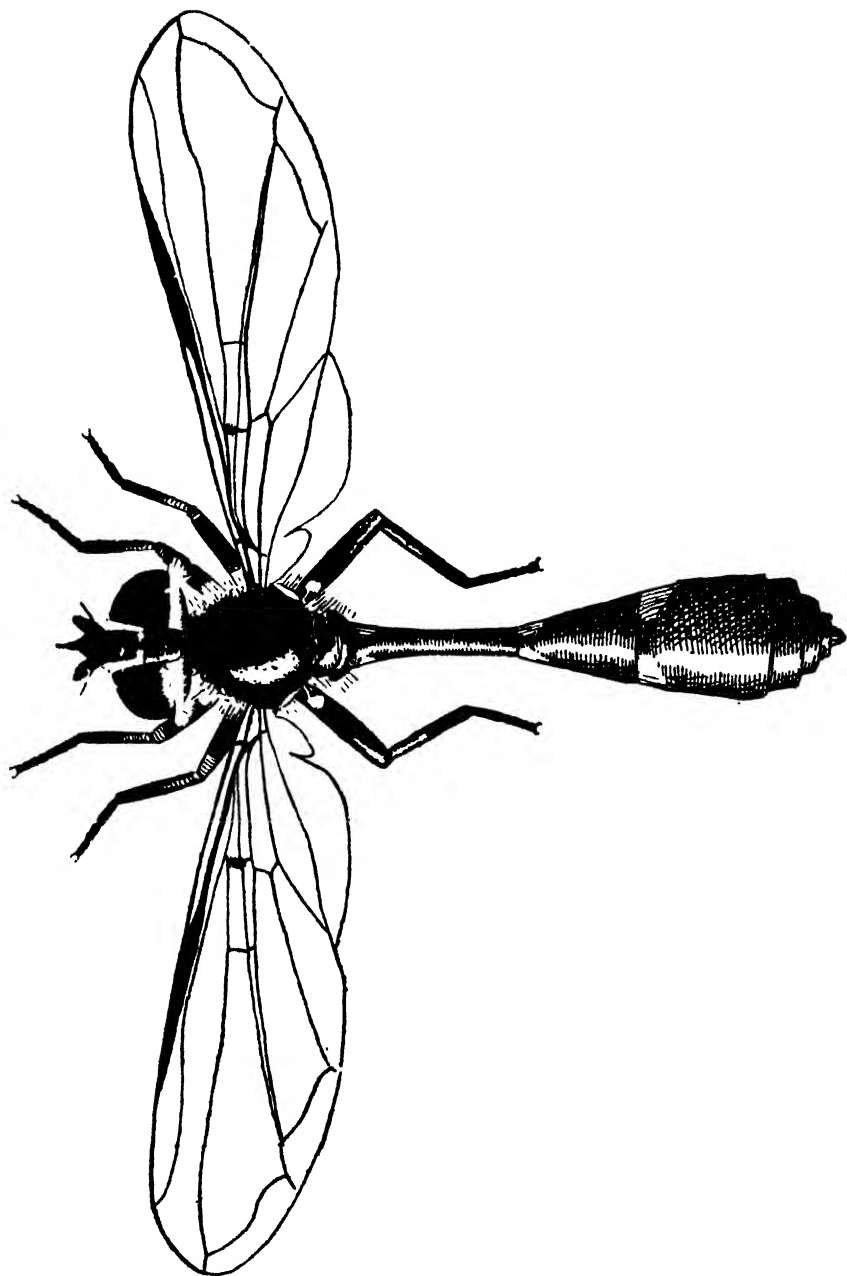


FIG. 3. *Baccha clavata* (Fabricius) Twelve times natural size. (Drawn by G. N. Wolcott.)

slug-like, semi-transparent, greenish yellow maggots, shaped like a very elongate triangle. Their bodies are adorned by numerous minute, transparent projections and are bluntly cut off behind, but their head ends are long and flexible, continually being waved about in search of its prey, when the maggots are not engaged in feeding. These maggots are very voracious and they feed all the time on the aphids, thus growing rapidly and attaining a much larger size than their prey in a short time. Pupation occurs on the leaves, a pear-shaped puparium being formed out of which a beautiful blue-black fly emerges in a few days.

No less interesting than this fly is the internal parasite of aphids, *Aphidius testaceipes* (Cresson). Wolcott, writing about this parasite says:

"Sometimes one finds a large mature grape-fruit leaf completely covered on one side with the dead bodies of extraordinarily large, plump and unnaturally rounded aphids, the back of each one having a small black hole. Through this hole has emerged a single, elongate black wasp, *Aphidius* sp. The female wasp in laying her egg, takes a position at some distance from the aphid to be parasitized, and facing it, then bends her elongate abdomen under her body and between her legs until its extended tip comes in contact with the abdomen of the aphid, into which the egg is quickly inserted. The maggot hatching from this egg feeds on the interior of the aphid. As the aphid is quite small in proportion to the size of the parasite, its growth is stimulated or its skin stretched, so that the body of the parasitized aphid becomes greatly distended, attaining an unnatural size far beyond that of normal, healthy aphids. The development of the parasite is so rapid that the adult wasp is ready to emerge in less than a week after the egg was deposited in the aphid. Ordinarily the wasp is so thoroughly efficient in her egg-laying activities, missing not a single aphid, as to completely wipe out the entire colony." (Wolcott, EEWI p. 432-3.)

Host: The following trees are attacked by the aphid in the Island:

<i>Calophyllum calaba</i> Jacq.	"maria"
<i>Coccolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Genipa americana</i> L.	"jagua"
<i>Mammea americana</i> L.	"mamey"
<i>Mangifera indica</i> L.	"mango"
<i>Ocotea leucoxylon</i> (Sw.) Mez	"laurel geo"
<i>Rapanea ferruginea</i> (R. & P.) Mez	"mantequero"

Cerataphis lataniae (Boisduval) is a species usually found on palms. As far as we know there is only one species in this genus on the Island. A species belonging to the allied genus *Aleurodaphis* also attacks palms in Puerto Rico. The two genera can be distinguished as follows: in *Cerata-*

phis the antennae of the aleyrodiforms are 4-jointed while in *Aleurodaphis* they are 5-jointed. The species is very characteristic and peculiar in shape and can be identified very easily. Wolcott, (EEWI p. 362-3) says the following about this aphid:

"A most peculiar aphid, *Cerataphis lataniae* (Boisduval) is reported from Jamaica as occurring on coconut, although it normally lives on orchids and ornamental plants. In Puerto Rico, a heavy infestation on an ornamental palm, observed for several years, did not spread to the overhanging leaves of a coconut palm, and the record in Jamaica doubtless represents exceptional instance. The aphids are far from typical, being black and lens shaped, and so little inclined to wander that a ring of whitish filaments surrounds each insect, like a halo, where it rests on the leaf." (For a description of the species see Gillete & Palmer, 1934, p. 241-42.)

Natural Enemies: The adults and larvae of the lady-bird beetle *Cycloneda sanguinea* Linnaeus prey upon these aphids, destroying large numbers of them.

Host: Recorded from "palma de Borbón", *Livistona chinensis* R. Br.

FAMILY COCCIDÆ

(Scale Insects and Mealybugs)

This family comprises a very large group of insects which in Puerto Rico are among the worst pests of trees. Some species are so injurious as to kill trees, others destroy branches and twigs. However in spite of the fact that some species are very abundant on trees no appreciable damage is observed. As a popular description of the insects will not be of much value in identifying the scale insects and technical descriptions are too complicated, the description of species will be omitted, except in a few instances. The host trees will be listed under each species.

Subfamily Monophlebinae

Crypticerya rosae (Riley & Howard)

This species which is usually found on the branches, twigs or trunk of trees growing at low altitudes in the Island, is not an abundant insect.

Natural Enemies: The phorid fly *Syneura cocciphila* Coquillett has been reared from this coccid and presumably is one of its main parasites.

Host: The following trees have been recorded as being infested by the coccid:

Casearia aculeata Jacq.

"cambrón"

Casuarina equisetifolia Forst.

"pino australiano"

Guaiacum officinale L.

"guayacán"

Haematoxylon campechianum L.

"campeche"

***Icerya montserratensis* Riley & Howard**

This is a fairly common species in Puerto Rico, usually found at low altitudes and elevations up to 1,300 ft. It is similar in appearance at first glance to the cottony cushion scale, *Icerya purchasii* Maskell, but upon inspection, many differences are noted between the two species (see fig. 4).

Natural Enemies: The insect is parasitized by certain hymenopterous insects, among them, the braconid *Rhyssalus bruneiventris* Ashmead and the encyrtids *Brethesiella* sp. and *Cheiloneurus pulvinariae* Dozier.

Host: The following trees in Puerto Rico have been recorded as host trees:

<i>Brysonima spicata</i> (Cav.) Rich.	"maricao"
<i>Calophyllum calaba</i> Jacq.	"maría"
<i>Casearia sylvestris</i> Sw.	"laurel espada"
<i>Casuarina equisetifolia</i> Forst.	"pino australiano"
<i>Chrysophyllum argenteum</i> Jacq.	"caimito verde"
<i>Cocos nucifera</i> L.	"coco"
<i>Ficus nitida</i> Thunb.	"laurel de la India"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Mammea americana</i> L.	"mamey"
<i>Psidium guajava</i> L.	"guayaba"
<i>Samanea saman</i> (Jacq.) Merrill.	"samán"

***Icerya purchasii* Maskell**

(The Cottony Cushion Scale)

This introduced species which for a short time appeared to be a serious threat to our agriculture is now under natural control. Although it has widely spread around the Island, fortunately it has become less destructive since it is readily controlled by its natural parasites and predators when it becomes abundant. Since its introduction this insect has been fully discussed in different publications issued by the Agricultural Experiment Station at Rio Piedras, P. R. (see IB, p. 120 and SIB, p. 56.)

The original home of this insect is said to be Australia from where it passed to New Zeland and subsequently into South Africa, Fiji, the Sandwich Islands, the West Indies and continental United States. The species also occurs in many parts of Europe (Portugal, France, Italy) (see Fig. 5).

Natural Enemies: The most important of the natural enemies of this pest is the coccinellid beetle, *Rodolia cardinalis* (Mulsant). Both the adult and larvae of this insect prey upon the coccid. The agromyzid fly *Cryptochaetum iceryae* (Williston) was introduced and several releases

were made at Mona Island to help in the control of the coccid which was infesting a plantation of young australian pines or casuarinas. Other predaceous and parasitic insects which also control the mealybug are the following: the coccinellid beetle *Decadiomus pictus* Chapin and the phorid fly *Syneura cocciphila* Coquillett. The fungus *Spicaria javanica* Bally has been also cited as an enemy of this insect. (Wolcott & Martorell, Feb. 1940, p. 202.)

Host: The following trees are recorded as being infested by this scale insect:

<i>Casuarina equisetifolia</i> Forst.	"pino australiano"
<i>Erythrina glauca</i> Willd.	"bucare"
<i>Isandrina emarginata</i> (L.) Britton & Rose	"vela muerto"
<i>Prosopis juliflora</i> (Sw.) DC.	"mesquite"
<i>Pithecellobium dulce</i> (Roxb.) Benth.	"algarrobo del Hawaii"

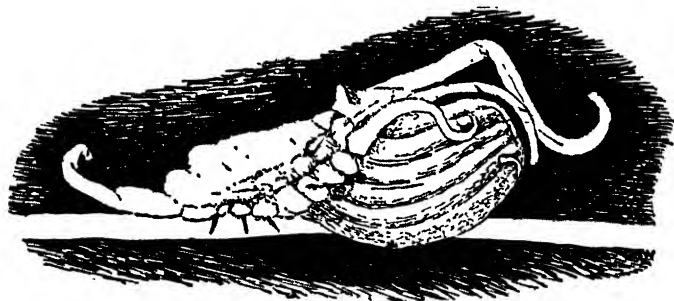


FIG. 4. *Icerya montserratensis* Riley & Howard. Five times natural size. (Drawn by G. N. Wolcott.)

Subfamily Ortheziinae

Orthezia insignis Douglas

This species although very abundant and injurious to small plants is seldom observed on trees. So far it has only been reported from "Martín Avila", *Chione venosa* (Sw.) Urban.

Subfamily Asterolecaniinae

Asterolecanium bambusae (Boisduval)

(The Bamboo Scale)

A very common species in Puerto Rico, ranging from low altitudes to middle elevations up to 2,000 ft., but more abundant in the lowlands. The species is cosmopolitan in its distribution and occurs in nearly every part of the tropical world. The scale is found on the leaves as well as the

stems of the host trees. The main host plant of this scale insect are the tree-like grasses belonging to the genus *Bambos*.

Natural Enemies: A native coccinellid beetle feeds on the coccid: *Scymnillodes cyanescens violaceus* Sicard. Recently several species of ladybird beetles have been introduced for the purpose of controlling this



FIG. 5. The cottony cushion scale, *Icerya purchasii* Maskell on twigs of australian pine, *Casuarina equisetifolia* Forst.

pest. Originally they came from Trinidad, Br. W. I. and were collected there while feeding on the bamboo scale. They are: *Cryptognatha nodiceps* Marshall, *C. simillima* Sicard and *Azya trinitatis* Marshall. After they were released here, they preferred feeding on the coconut scales rather than on those of bamboo. Two more coccinellids, *Egus platycephalus* Mulsant from Cuba and *Chilocorus cacti* (Linn.) from Cuba and Texas, were also introduced. Like the others they seem to prefer other scales but the one on bamboo.

Host : Recorded from *Bambos vulgaris* Schrad, our common "bambúa". The insect has been observed infesting various different species of bamboo planted at the Agricultural Experiment Station at Mayagüez, but the exact names of the plants have not been given.

***Asterolecanium longum* (Green)**

Not a common species in the Island, only recorded from "bambúa", *Bambos vulgaris* Schrad.

***Asterolecanium miliaris miliaris* (Boisduval)**

Another species which is not abundant in the Island also recorded from "bambúa", *Bambos vulgaris* Schrad., and listed from other species of bamboo at Mayaguez.

***Asterolecanium pustulans* (Cockerell)**

(The Pustule Scale)

This is our most injurious species to forest trees in Puerto Rico affecting a wide variety of trees. The insect is cosmopolitan in its distribution. Russell, 1941, discussing this species in her monograph of the genus lists the localities where the species has been previously collected and the host plants. (Russell, 1941, p. 167-8.)

Habits : The pustule scale, as the name implies, is a pustule or pit producing insect. These pits produced on the bark of the trunk, branches and twigs, make the species very distinguishable, since we do not have in the Island any other species capable of producing such injury. The depth of these pits depends chiefly on the host plant infested, certain tree species being very susceptible to the attack of the insect and thus having deep pits produced while in others they are very shallow.

This scale insect sometimes kills whole trees, especially in the susceptible species like *Sciacassia siamea* (Lam.) Britton and *Grevillea robusta* A. Cunn. Wolcott, Oct. 1940, p. 6, making reference to an infestation of this insect on "maga", *Montezuma speciosissima* Sessé & Moc. says :

"Observations made during the past few months by the writer and Mr. L. F. Martorell indicate a surprisingly extensive infestation by *Asterolecanium pustulans* (Cockerell) on roadside specimens of "maga" from Dorado to Isabela. Infestations are readily noted, for even a small number of scales on a twig causes all the leaves to die and turn brown. Injury resembles fire blight of pear and apple, for the dead leaves remain attached to the dead twig for some time in a manner very different from the natural maturity of the leaves which drop as soon as they become yellow. The scale does not produce as deep a pustule as on some other hosts, but its

effect is more rapidly toxic in causing prompt death of the infested twig or branch. For the most part, the trunk and the main shoot are rarely infested, but one sometime sees as many as half of the lateral branches infested and killed at one time. This widespread infestation on maga may be a very recent development, for no old records of infestation on this host are available, and it may disappear as rapidly as it has appeared, but just at present it looks serious."

Comparing the depth of the pits produced on this host trees with others like *Sciacassia siamea* (Lam.) Britton, *Grevillea robusta* A. Cunn. and *Conocarpus erectus* L., one comes to the conclusion as to the depth or character of the pits in relation to the susceptibility of the host.

The insect ranges from the lowlands to the middle altitudes, but as far as observations have demonstrated, the coccid is not so dangerous, neither so abundant at altitudes over 1,000 ft., as on the lowlands.

Natural Enemies: Fortunately the insect is eventually reduced to control by means of its natural parasites, all minute wasps: the mymarid, *Alaptus borinquensis* Dozier, the aphelinid, *Aspidiotiphagus citrinus* (Craw.) and the encyrtids, *Euaphycus portoricensis* Dozier and *Macetiella reticulata* Dozier.

Host: The insect affects the following trees in our Island:

<i>Annona muricata</i> L.	"guanábana"
<i>Annona reticulata</i> L.	"corazón"
<i>Bambos vulgaris</i> Schrad.	"bambúa"
<i>Cassia fistula</i> L.	"caña fistula"
<i>Conocarpus erectus</i> L.	"botoncillo"
<i>Cupania americana</i> L.	"guara"
<i>Delonix regia</i> (Bojer) Raf.	"flamboyán"
<i>Grevillea robusta</i> A. Cunn.	"roble australiano"
<i>Inga vera</i> Willd.	"guaba"
<i>Mangifera indica</i> L.	"mango"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Ochroma lagopus</i> Sw.	"guano"
<i>Rapanea guianensis</i> Aubl.	"bádula"
<i>Rauwolfia nitida</i> Jacq.	"palo amargo"
<i>Salix chilensis</i> Molina	"sauce"
<i>Sciacassia siamea</i> (Lam.) Britton	"casia amarilla"
<i>Ternstroemia stahlii</i> Krug & Urban	"mamey del cura"
<i>Zanthoxylum flavum</i> Vahl	"aceitillo"

Subfamily Pseudococcinae

This subfamily includes a group of insects commonly known as mealybugs. Generally they are easily separated from the other members

of the family by their large size and flour-like covered bodies, because of which they are called in Spanish "chinchas harinosas." Generally they are found on the undersides of the leaves, but also on the twigs and smaller branches. When abundant they cause injuries of economic importance. Some species are abundant in the lowlands as well as middle altitudes. Most of the insular species in this subfamily are included in one genus: *Pseudococcus*. The following are the species affecting our trees:

***Pseudococcus brevipes* (Cockerell)**

This insect is one of the worst pests of pineapple, *Ananas sativus* Schult. f., in the Island. Fortunately it affects very few trees and is not abundant on them. The principal characteristics in identifying the insects are the following:

Adult female: The adult female is very pale, olivaceous or greyish, or obscurely yellowish, with a close but not very dense covering of white powdery secretion; margin with short, subconical waxy tassels, most of which may be missing in old specimens. Body rather broadly ovate, convex and tumescent above, flattish beneath; limbs and antennae relatively small. Antennae either seven or eight jointed; terminal joint always the longest and markedly stouter than the preceding joints. Ceriferous tracts seventeen on each side, each with from two to four (rarely five) small but stout conical spines, three or four slender setae, and an irregular group of small ceriferous pores. Average length 2 to 3 mm., width 1.5 to 2 mm. (Green 1922, part 5, p. 381).

Host: Recorded from "jagüey", *Ficus laevigata* Vahl and "tamarindo", *Tamarindus indicus* L.

***Pseudococcus adonidum* (Linnaeus)**

A fairly common species in Puerto Rico, regarded as a cosmopolitan insect, but limited to greenhouses in the temperate regions of the world. The chief characteristics of the species are as follows:

Adult female: The adult female is elongate ovate, at first dull pinkish orange, the older individuals greyish orange. Limbs yellowish. Dorsum thinly covered with white mealy secretion, almost completely hiding the color of the insect. Margin with a complete fringe of white tassels (seventeen on each side) which are shorter in front, and increase in length towards the posterior extremity, the terminal four being exceptionally long, sometimes exceeding the length of the body of the insect. Average length from 3.5 to 4 mm. (see fig. 6.) (Green 1922, part 5, p. 383.)

Natural Enemies: The coccid is parasitized by the encyrtid wasp, *Acerophagus nubilipennis* Dozier.

Host: The mealybug attacks the following trees in the Island: *Barring-*

tonia speciosa Forst., "maría", *Calophyllum calaba* Jacq., "bucare", *Erythrina glauca* Willd. and "esmajagua", *Pariti tiliaceum* (L.) Hil.

***Pseudococcus citri* (Risso)**

(The Citrus Mealybug)

This cosmopolitan pest is abundant in Puerto Rico, attacking a wide variety of crops and other plants, but seldom observed on trees. As its

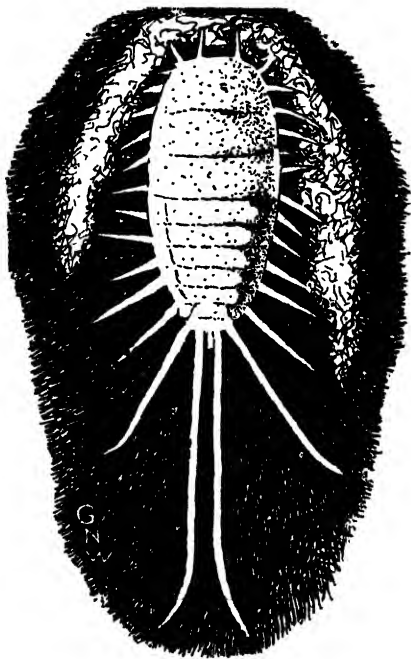


FIG. 6. *Pseudococcus adonidum* (Linn.) Twelve times natural size. (Drawn by G. N. Wolcott.)

name implies it is chiefly a pest of citrus trees. The following are the characteristics of the species:

Adult female: The adult female is yellowish, pinkish yellow, purplish or greyish yellow above; usually yellowish beneath. The color on the dorsum is almost completely concealed by a close covering of white mealy powder; there is usually, however, a median and sometimes a lateral stripe partially free from the secretion, revealing the true color of the insect. The venter is only thinly dusted with mealy powder. There is a complete marginal series of thirty-four short, stout, white, waxy tassels, subequal in length, tough rather stouter on the abdominal segments. Between

the last pair of tassels is a pair of small ligulate processes of a denser and smoother wax, proceeding from the anal orifice. Form broadly oval, convex above, flattish below, with the segments more or less tumescent. Average size 2.6 mm. long.

The specimens in nature are readily distinguished from the related form *P. adonidum* (Linnaeus) by the shorter and stouter fringe of waxy tassels. Dried specimens (which usually lost their appendages) are not so easily separated. The following microscopical points may be used in separating both species :

P. citri (Risso) has thirty-six marginal ceriferous tracts, the spines on each of equal diameter; caudal setae much longer than those of the anal ring; tarsus approximately half the length of the tibia.

P. adonidum (Linnaeus) has thirty-four marginal ceriferous tracts, the spines of the terminal and penultimate tracts conspicuously larger and stouter than those on the remaining tracts; caudal setae scarcely longer than those of the anal ring; tarsus approximately one-third length of tibia. (Notes from Green 1922, part 5, pp. 376-7.)

Host : Recorded from "maga", *Montezuma speciosissima* Sessé & Moc.

***Pseudococcus maritimus* (Ehrhorn)**

This species although not common in the island has been recorded several times on different host plants. The species probably occurs throughout the tropical and subtropical regions of the world, but due to its similarity to *P. adonidum* (Linnaeus) its identity may have been overlooked.

Adult female : The adult female is grayish or dull pink, the dorsum closely covered with white mealy secretion. Form long ovate, length approximately twice the breadth. Margin with seventeen equidistant, slender, straight, waxy tassels on each side, short on the anterior parts, and progressively longer towards the posterior extremity of the body, the posterior (caudal) pair of tassels twice as long as the preceeding pair, and more than half the length of the actual body of the insect. Antenna eight-jointed, third and eighth joints longest, subequal. (In *P. adonidum*, the antenna is eight-jointed but the eighth segment is considerably the longest, first, second and third, next longest and approximately equal; fourth to seven shortest but varying in their relative lengths.) One more characteristic which serves to differentiate these two species is that in *adonidum* the tibia of the hind leg possesses conspicuous translucent spores, which in this particular species are crowded. The next closest species to this one is *P. comstocki* and here the translucent spots are scattered. (Green 1922, part 5, p. 384.)

Host : Recorded from "tamarindo", *Tamarindus indicus* L.

***Pseudococcus nipae* (Maskell)**

This mealybug is undoubtedly our most common member of the genus. It is quite different in appearance from the rest of the insular species and it does not need a complete description for its identification. The insect occurs usually on the undersides of the leaves, but also may be present on twigs and smaller branches. It ranges from the lowest elevations up to



FIG. 7. *Pseudococcus nipae* (Maskell) Twenty times natural size. (Drawn by G. N. Wolcott.)

the middle and higher altitudes as high as 2,500 ft., rarely higher (see fig. 7).

Adult female: The adult female is short, oval, covered with yellowish white cereous matter, arranged almost in the same way as in the genus *Orthezia*, but much less compact; margin all around with a series of downward, curved, broad, laterally joined, lamellae, longest behind; dorsum rarely presenting regular plates; when such is the case, however, they are arranged in thick squarish masses, with the body of the insect showing

through the divisions; generally the dorsum is covered with one conglomerate mass, with little or no segmentation. Length about 2 mm. or more. (Notes from Newstead, 1893 p. 187.)

Natural Enemies: In Puerto Rico the insect is controlled by a group of predators and parasites, all of which seem to be very effective in controlling the pest. The chrysopid, *Chrysopa collaris* Schneider, presumably feeds on this insect. The coccinellid beetles *Hyperaspis connectens* Thunberg, *H. apicalis* Mulsant, *Cryptolaemus montrouzieri* Mulsant, *Scymnillus nunnmacheri* Sicard and *S. variipennis* Sicard prey upon the coccid. These ladybird beetles are the most effective means of control, both the larvae and adult feeding on them. The entomogenous fungi, *Cephalosporium lecanii* Zimm., *Empusa fresenii* Nowak and *Botrytis Rileyi* Farlow have been recorded as parasitizing this mealybug.

Host: The insect attacks a large variety of trees and shrubs in Puerto Rico. The following have been recorded:

<i>Annona muricata</i> L.	"guanábana"
<i>Annona reticulata</i> L.	"corazón"
<i>Barringtonia speciosa</i> Forst.	"coco marino"
<i>Calophyllum calaba</i> Jacq.	"maría"
<i>Chrysophyllum argenteum</i> Jacq.	"caimito verde"
<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Coccolobis wuifera</i> (L.) Jacq.	"uva de playa"
<i>Cocos nucifera</i> L.	"coco"
<i>Erythrina glauca</i> Willd.	"bucare"
<i>Ficus laevigata</i> Vahl	"jagüey"
<i>Ficus lyrata</i> Warb.	"palo de goma"
<i>Ficus sintenisii</i> Warb.	"jagüey"
<i>Ficus stahlii</i> Warb.	"jagüey"
<i>Guarea trichilioides</i> L.	"guaraguao"
<i>Ilex nitida</i> (Vahl) Maxim	"brigüeta naranjo"
<i>Livistona chinensis</i> R. Br.	"palma de Borbón"
<i>Mammea americana</i> L.	"mamey"
<i>Miconia prasina</i> (Sw.) DC.	"camasey"
<i>Micropholis garcinifolia</i> (Pierre) Urban	"caimitillo"
<i>Nectandra coriacea</i> (Sw.) Griseb.	"avispillo"
<i>Nectandra membranacea</i> (Sw.) Griseb.	"laurelillo"
<i>Nectandra sintenisii</i> Mez.	"laurel amarillo"
<i>Ocotea floribunda</i> (Sw.) Mez	"laurel"
<i>Ocotea portoricensis</i> Mez	"laurel"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Phoebe elongata</i> (Vahl) Nees	"laurel bobo"
<i>Psidium guajava</i> L.	"guayaba"

<i>Sloanea berteriana</i> Choisy	"cacao motillo"
<i>Sterculia apetala</i> (Jacq.) Karst.	"anacagüitas"
<i>Tetrazygia elaeagnoides</i> (Sw.) DC.	"cenizo"
<i>Torrubia fragans</i> (Dum.-Cours.) Standly	"corcho prieto"
<i>Trema lamarckiana</i> (R. & S.) Blume	"cabrilla"

***Pseudococcus virgatus* (Cockerell)**

This species has been recorded several times from the Island, but is not very abundant. Elsewhere it occurs in Jamaica, (from which it was originally described) Sandwich Islands, Mauritius, Mexico and Texas. The species was described as follows:

"Female: 4.5 mm. long. Very white mealy brown above, except dark purplish grey subdorsal stripes, which are broadly interrupted centrally. Caudal filaments about 2 mm. long, i.e., about half length of body. No obvious lateral appendages. Segmentation distinct. Beneath whitish, legs pale brown. The caudal filaments are rather slender but not filiform. The lateral appendages seem to be represented by long and very fine hairs, which are obvious in the young, but are lost in the adult. Very young individuals are pale yellow. Femur (of adult) about as long as tibia; tibia about three times as long as tarsus. Antennae with eight joints, 3 and 8 subequal, or 8 a little longer; 2 sensibly shorter than 3; 4 rather longer than 5; 5, 6 and 7, about equal." (Described as *Dactylopius virgatus* Cockerell, 1893 p. 178.)

Host: Infesting the following trees:

<i>Cicca disticha</i> L.	"grosella"
<i>Inga vera</i> Willd.	"guaba"
<i>Melicocca bijuga</i> L.	"quenepa"
<i>Terminalia catappa</i> L.	"almendra"

***Antonina bambusae* (Maskell)**

This coccid is not common in the Island. It has been previously recorded from the Sandwich Islands, Mauritius, Ceylon and Brazil.

Host: Only recorded from the common "bambúa", *Bambos vulgaris* Schrad.

Subfamily Coccinae

***Pulvinaria psidii* Maskell**

A common species in the Island, collected at low and middle elevations. Fortunately the insect is kept under control by its natural enemies and no heavy outbreaks are noticeable.

Natural Enemies: One of the most efficient enemies of this coccid is

the Australian ladybird beetle, *Cryptolaemus montrouzieri* Mulsant. The ochthiphilid fly *Leucopsis bella* Loew has been reared from the insect also.

Host: The coccid attacks the following trees in the Island:

<i>Cedrela mexicana</i> Roem.	"cedro"
<i>Cedrela odorata</i> L.	"cedro español"
<i>Chrysophyllum cainito</i> L.	"caimito"
<i>Citharexylum fruticosum</i> L.	"péndula"
<i>Ficus sintenisii</i> Warb.	"jagüey"
<i>Mangifera indica</i> L.	"mango"
<i>Manilkara pleyana</i> (Pierre) Cronquist	"mameyuelo"
<i>Psidium guajava</i> L.	"guayaba"
<i>Rauwolfia nitida</i> Jacq.	"palo amargo"
<i>Spondias dulcis</i> Forst.	"cítara"
<i>Trema lamarckiana</i> (R. & S.) Blume	"cabrilla"

***Pulvinaria urbicola* Cockerell**

A species not common in the Island, also listed from Jamaica, Barbados and Trinidad.

Host: Recorded from "uva de playa", *Coccolobis uvifera* (L.) Jacq.

***Cryptostigma inquilina* (Newstead)**

Fairly abundant in the Island, especially in coffee groves where it attacks coffee and its shade trees. This coccid is attended by the ant or "hormiguilla", *Myrmelachista ramulorum* Wheeler which occurs abundantly in coffee groves. Writing about this ant Wolcott says as follows:

"In some compartments of their tunnels they rear their young, in others they care for the fleshy, pink scale insects, or the mealybugs, that suck sap from the tree and secrete a honey-dew eaten by the ants. These fleshy, pink scale insects have been found only in connection with colonies of ants, for they live only in tunnels in the live wood made by the ants, never being found on the outside of the tree." (EEWI, p. 316.)

Host: The following trees are attacked in Puerto Rico by this coccid:

<i>Ficus laevigata</i> Vahl	"jagüey"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"

***Ceroplastes ceriferus* (Anderson)**

(Japanese Wax Scale)

This scale insect is not common in the Island. It has been recorded from India, Australia, Ceylon, Japan, Hawaiian Islands, Chile, Mexico, Antigua and Jamaica.

Host: Recorded from "almácigo", *Bursera simarouba* (L.) Sarg.

Ceroplastes cirripediformis Comstock

(The Barnacle Scale)

This insect is a pest of orchard fruits, but also attacks other trees in the Island which does not belong to this group. It has been listed from Florida, Mexico, Louisiana and the West Indies.

Natural Enemies: The following parasitic insects help in the natural control of this coccid: the aphelinid wasps, *Marietta busckii* (Howard), *Plagiomerus cyanea* (Ashmed), *Aneristus ceroplastae* Howard and the encyrtid *Aphycus* sp. near *eruptor* Howard.

Host: The following trees are attacked by this insect in Puerto Rico:

<i>Cedrela mexicana</i> Roem.	"cedro"
<i>Guaiacum officinale</i> L.	"guayacán"
<i>Myrcia citrifolia</i> (Aubl.) Urban	"hoja menuda"
<i>Rauwolfia nitida</i> Jacq.	"palo amargo"

Ceroplastes floridensis Comstock

(Florida Wax Scale)

Fairly abundant in Puerto Rico, recorded from a long list of trees and shrubs. Also distributed throughout the tropical and subtropical parts of the globe, Central America, Brazil, British Guiana, Cuba, Bermuda, Florida, Louisiana, Mississippi, Australia and the Orient.

Host: In the Island it has been recorded from the following trees:

<i>Annona reticulata</i> L.	"corazón"
<i>Elacodendrum xylocarpum</i> (Vent.) DC.	"cosecorrón"
<i>Ficus laevigata</i> Vahl	"jagüey"
<i>Ficus nitida</i> Thunb.	"laurel de la India"
<i>Genipa americana</i> L.	"jagua"
<i>Laguncularia racemosa</i> (L.) Gaertn.	"mangle bobo"
<i>Mangifera indica</i> L.	"mango"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Psidium guajava</i> L.	"guayaba"
<i>Rapanea guianensis</i> Aubl.	"bádula"

Ceroplastes denudatus Cockerell

This scale insect was introduced into Puerto Rico several years ago and was first reported on the introduced African cloth bark trees, at the Muñoz Rivera Park, Puerto de Tierra. Also found in Antigua and Demerara. Not a common species in the Island, being limited in its distribution.

Host: Recorded from the African cloth bark tree, *Ficus nekbuda* Warb, and from coconut palm, *Cocos nucifera* L., in the vicinity of the original hosts.

Vinsonia stellifera (Westwood)

A very common species in the Island, also recorded from Trinidad, Jamaica, Antigua, Barbados, Demerara, Grenada, Brazil, Central America, California and Ceylon. This coccid is found at low and middle altitudes.

Adult Female: The adult female is covered by a transparent waxy test, the margins of which are flattened and produced into seven rays that give the insect the appearance of a miniature star-fish. The color of living specimens is pink, darkening with age to purplish red. In dried specimens this tint fades to reddish brown. The anal operculum is dark brown. Margin colorless during life and yellowish in dry specimens. A pair of small white waxy processes project from the posterior margin immediately behind the anal aperture. Diameter across the median rays, 3.5 to 4.5 mm. (Green 1909, part 4, p. 280.)

Host: The following trees have been recorded as being affected by this scale insect:

<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Eugenia jambos</i> L.	"pomarrosa"
<i>Lawsonia inermis</i> L.	"resedá"
<i>Mangifera indica</i> L.	"mangó"
<i>Psidium guajava</i> L.	"guayaba"

Inglisia vitrae Cockerell

This scale insect is rare in the Island. It is also found in Trinidad.

Host: Recorded from "achiote", *Bixa orellana* L. and "guaba", *Inga vera* Willd.

Eucalymnatus tessellatus (Signoret)

A fairly common species in Puerto Rico, also recorded from France, England, Australia, Mauritius, Hawaii, Ceylon and Jamaica.

Natural Enemies: The parasitic wasp, *Aneristus ceroplastae* Howard (Aphelinidae) has been reared from this coccid.

Host: The scale insect has been found affecting the following trees:

<i>Calophyllum calaba</i> Jacq.	"maría"
<i>Eugenia malaccensis</i> L.	"pomarrosa malaya"
<i>Mangifera indica</i> L.	"mangó"
<i>Sideroxylon foetidissimum</i> Jacq.	"tortugo amarillo"

Coccus acuminatus (Signoret)

(Mango Shield Scale)

This scale insect is not abundant in our Island. It has been recorded from the United States, Bahamas, Jamaica, Cuba, Grenada, Antigua, Barbados, Mexico and the Orient.

Adult female: The adult female is of a pale green or yellowish green color, thin, flat and shaped like an irregular triangle, having a length of about 3 mm.

Signoret, in the description of this species says, "Cette espèce est facile à distinguer par la forme de son corps ovale court, acuminée vers le sommet, arrondi, très large vers l'extrémité. Les antennes sont de sept articles avec le quatrième le plus long, le troisième égal aux cinquième et sixième réunis, ceux-ci les plus courts, le septième aussi long que les deux précédents. Les pattes, larges, aplaties offrent un tarse court, à peine de moitié aussi long que le tibia; le reste comme dans les *Lecanium* en general. La longueur est de 2-3 millimètres." (Green 1904, part 3, page 195.)

Host: The following trees have been recorded as host species:

<i>Bixa orellana</i> L.	"achiote"
<i>Eugenia jambos</i> L.	"pomarrosa"
<i>Eugenia malaccensis</i> L.	"manzana malaya"

Coccus hesperidum Linnaeus

(The Brown Soft Scale)

Another coccid which is not abundant in the Island and however it is a cosmopolitan species recorded from tropical and subtropical regions of the world.

Adult female: The adult female is bright yellow or greenish yellow, minutely speckled with red-brown, the specks sometimes agglomerated into transverse bars, especially on the median abdominal region, in other parts tending to form dotted lines radiating from the center to the margin. In older individuals the ground color may be ochreous or pale fulvous; and the maculation may form a broad median fascia. Form oblong-oval often very irregular in outline, narrowest in front, more or less convex above, according to age. Length from 2.25 to 3.5 mm. Width 1.25 to 2.50 mm. The insect is ovoviviparous and the living larvae are usually found beneath the body of the parent. (Green 1904, part 3, p. 188).

Natural Enemies: The coccid is parasitized by the aphelinid wasp, *Coccophagus lunulatus* Howard.

Host: Only recorded from two trees in the Island:

<i>Cicca disticha</i> L.	"grosella"
<i>Mangifera indica</i> L.	"mangó"

Coccus mangiferae (Green)

Fairly abundant in the Island, also recorded from Jamaica, Trinidad, Barbados, Antigua, Grenada and Ceylon.

Adult female: The adult female is pale yellowish green, the malphigian

tubules showing through the skin of the dorsum as an indistinct chain of oblong fulvous spots. Deltoid, bluntly pointed in front, broadly rounded behind, usually asymmetrical. Very thin; margin broadly flattened, with slight ridges above the stigmatic areas. Antennae with eight joints, second and eighth equal and longest, seventh always shortest. Length from 3 to 4 mm. Width 2.5 to 3.5 mm. (Green 1904, part 3, p. 216).

Natural Enemies: The entomogenous fungi *Cephalosporium lecanii* Zimm. and *Botrytis Rileyi* Farlow are very effective enemies of the coccid in the field.

Host: The following trees are recorded as host species:

<i>Artocarpus communis</i> Forst.	"pana"
<i>Cinnamomum zeylanicum</i> Nees	"cancla"
<i>Eugenia jambos</i> L.	"pomarroza"
<i>Mangifera indica</i> L.	"mangó"

Coccus viridis (Green)

(The Green Scale)

This is one of our most abundant and pestiferous scale insects ranging from the lowlands up to middle elevations. It is a pest of coffee and citrus not only in Puerto Rico but in Brazil, Ceylon and Mauritius. On account of its intensive infestations on coffee, it caused the abandonment of the cultivation of this crop on large sections of the coffee districts in Ceylon.

Adult female: The adult female is bright pale green, with an irregular, but very distinct loop of blackish spots on the middle of the dorsum (the contents of the malpighian tubules). Dried specimens become dull fulvous, and lose the chain of dark spots. Eyes conspicuous, black, close to margin. Oval in form, rounded behind, subacuminate in front, moderately convex above, especially in females with ripe ova. Antennae seven jointed; third and fourth longest subequal; seventh nearly equal to previous two together. Length 2.5 to 3.25 mm; width 1.5 to 2 mm.

Habits: The scale insects are more abundant on the undersides of the leaves, especially towards the midrib. Very often they attack the young shoots and when this occurs they cover the entire shoot and all one can see is a uniform mass of scale insects. Usually the presence of this species is related to sootie-mold. The foliage turns black or rather looks black, because every leaf is covered with a thin coat of the mold. The fire ants *Solenopsis geminata* are usually seen attending this coccid.

Natural Enemies: This species is very effectively controlled by the entomogenous fungi *Cephalosporium lecanii* Zimm.

Host: The following host trees have been recorded:

<i>Citharexylum fruticosum</i> L.	"péndula"
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<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"
<i>Coccolobis venosa</i> L.	"calambreña"
<i>Guarea trichilioides</i> L.	"guaragua"
<i>Lagerstroemia speciosa</i> (L.) Pers.	"reina de las flores"
<i>Miconia prasina</i> (Sw.) DC.	"camasey"
<i>Psidium guajava</i> L.	"guayaba"
<i>Rauwolfia nitida</i> Jacq.	"palo amargo"
<i>Sideroxylon foetidissimum</i> Jacq.	"tortugo amarillo"
<i>Tectona grandis</i> L.	"teck"
<i>Terminalia catappa</i> L.	"almendra"

Saissetia hemispaherica (Targioni)

(The Hemispherical Scale)

This is one of our most common scale insects and well known by nearly every farmer. The species is cosmopolitan in its distribution and occurs in tropical as well as subtropical regions of the globe. It is chiefly a pest of coffee and citrus, but attacks a wide variety of plants and trees also.

Adult female: As the name implies the female of this species is oval in shape, hemispherical, the margin usually outturned and slightly flattened, but often concealed by the bulging sides. The color varies from pale brownish fulvous to deep chestnut brown; all intermediate shades being represented often on a single plant. The dorsal surface is highly chitinous, polished and shiny. The size of the insect is very variable, from 2 to 3 mm. long and 1.2 to 2 mm. in width. (Green 1904, part 3, p. 233).

Habits: The insect usually infests the twigs and smaller branches of host plants, sometimes going under the leaves. They are abundantly found in the lowlands as well as at middle elevations, up to 2,000 ft. When abundant they cause injury to twigs and tender shoots killing many of them.

Natural Enemies: Undoubtedly one of the most efficient means of natural control of this pest is by means of the common entomogenous fungus, *Cephalosporium lecanii* Zimm., which has been recorded many times as attacking this coccid. The fly *Cecidomyia coccidarum* Cockerell has been reared from the scale; also the aphelinid wasp, *Aneristus ceroplastae* Howard.

Host: The scale insect has been recorded from the following trees:

<i>Annona muricata</i> L.	"guanábana"
<i>Annona reticulata</i> L.	"corazón"
<i>Ardisia obovata</i> Desv.	"mameyuelo"
<i>Eugenia jambos</i> L.	"pomarroza"
<i>Lawsonia inermis</i> L.	"resedá"
<i>Mammea americana</i> L.	"mamey"

<i>Myrcia deflexa</i> (Poir.) DC.	"cieneguillo"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Psidium guajava</i> L.	"guayaba"
<i>Psychotria berteriana</i> DC.	"palo moro"
<i>Rauwolfia nitida</i> Jacq.	"palo amargo"
<i>Sideroxylon foetidissimum</i> Jacq.	"tortugo amarillo"
<i>Spathodea campanulata</i> Beauv.	"tulipán africano"
<i>Spondias cironella</i> Tussac	"ciruela"
<i>Tamarindus indicus</i> L.	"tamarindo"
<i>Tectonia grandis</i> L.	"teck"

Saissetia nigra (Nietner)

Fairly abundant in Puerto Rico; but not so common as *S. hemisphaerica* and *S. oleae*. The species has more or less the same habits as *hemisphaerica* and is found in the lowlands as well as at middle elevations. Cosmopolitan in distribution and with a long list of host plants from all parts of the tropical and subtropical world.

Adult female: The adult females are very variable in size, form and color. The typical form is irregularly oval, usually asymmetrical, narrowed in front; strongly convex, the dorsum above the abdominal region sometimes forming a pronounced hump. The color of the mature insect varies from bright castaneous to deep purple black, the tint usually deepening with age. The surface is smooth, but not highly polished, faintly papillose. Length 3 to 5 mm.; width 2 to 3 mm. (Green 1904, part 3, p. 229.)

Natural Enemies: The encyrtid wasp, *Arrhenophagus chionaspidis* Aurivillius and the eupelmid, *Eupelmus coccidivorous* Gahan are parasites of this scale insect in Puerto Rico.

Host: The scale insect has been recorded from the following trees:

<i>Barringtonia speciosa</i> Forst.	"coco marino"
<i>Ficus laevigata</i> Vahl	"jagüey"
<i>Ficus stahlii</i> Warb.	"jagüey"
<i>Hura crepitans</i> L.	"javillo"
<i>Melia azedarach</i> L.	"alilaila"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Moringa oleifera</i> Lam.	"ben"
<i>Terminalia catappa</i> L.	"almendra"

Saissetia oleae (Bernard)

(The Black Scale)

This is the most abundant species of this genus in the Island. It has been also recorded from the tropical and subtropical regions of the world

and attacks a wide variety of plants. In Puerto Rico it occurs in the lowlands as well as at middle altitudes up to 2,500 ft., commoner near the coast.

Adult female: The adult female is densely chitinous, dull purplish brown, surface roughened and minutely specked with small grayish or colorless waxy granules. Form highly convex, usually distinctly angular, with prominent median longitudinal and two transverse ridges; a smaller longitudinal raised line connects the transverse ridges on each side. These ridges on the dorsum usually have the form of an H, this being one of the distinguishing characteristics of the species. (Green 1904, part 3, p. 227.)

Habits: This insect has more or less the same habits as its related forms *hemisphaerica* and *nigra*. It is usually found on the twigs and smaller branches and very seldom on the foliage of trees.

Natural Enemies: The caterpillar of the phycitid moth, *Laetilia portoricensis* Dyar has been recorded as feeding on this coccid. The eupelmid wasps, *Eupelmus saissetiae* Silvestri and *Lecanobius cockerelli* Ashmead are effective parasites of this scale.

Host: The following are the host trees, recorded in Puerto Rico:

<i>Andira jamaicensis</i> (W. Wright) Urban	"moca"
<i>Annona muricata</i> L.	"guanábana"
<i>Cedrela mexicana</i> Roem.	"cedro"
<i>Cordia alliodora</i> (R. & P.) Cham.	"capá prieto"
<i>Cordia sulcata</i> DC.	"moral"
<i>Crescentia cujete</i> L.	"higüera"
<i>Erythrina berteriana</i> Urban	"machete"
<i>Erythrina glauca</i> Willd.	"bucare"
<i>Erythrina poeppigiana</i> (Walp.) O. F. Cook	"bucare"
<i>Ficus laevigata</i> Vahl	"jagüey"
<i>Ficus nitida</i> Thunb.	"laurel de la India"
<i>Gleditsia triacanthos</i> L.	honey locust
<i>Guarea trichilioides</i> L.	"guaraguo"
<i>Guazuma ulmifolia</i> Lam.	"guácima"
<i>Isandrina emarginata</i> (L.) Britton & Rose	"vela muerto"
<i>Eugenia jambos</i> L.	"pomarrosa"
<i>Lagerstroemia speciosa</i> (L.) Pers.	"reina de las flores"
<i>Manilkara bidentata</i> (A. DC.) Chev.	"ausubo"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Ocotea portoricensis</i> Mez	"laurel"
<i>Petitia domingensis</i> Jacq.	"capá blanco"
<i>Psidium guajava</i> L.	"guayaba"
<i>Sciacassia siamea</i> (Lam.) Britton	"cassia amarilla"
<i>Sideroxylon foetidissimum</i> Jacq.	"tortugo amarillo"

<i>Spathodea campanulata</i> Beauv.	"tulipán africano"
<i>Spondias dulcis</i> Forst.	"cítara"
<i>Sterculia apetala</i> (Jacq.) Karst.	"anacagüitas"
<i>Swietenia mahagoni</i> Jacq.	"caoba"
<i>Tamarindus indicus</i> L.	"tamarindo"
<i>Tectona grandis</i> L.	"tcek"
<i>Terminalia catappa</i> L.	"almendra"
<i>Trema lamarckiana</i> (R. & S.) Blume	"cabrilla"
<i>Trema micrantha</i> (L.) Blume	"palo de cabra"
<i>Zanthoxylum flavum</i> Vahl	"aceitillo"

Chionaspis citri Comstock

Host: Recorded only from "mango", *Mangifera indica* L. This scale insect is chiefly a pest of citrus, not affecting ornamental, shade or forest trees.

Howardia biclavis (Comstock)

(The Mining Scale)

This is a common species in the Island also recorded from the tropical and subtropical regions of the world. In Puerto Rico the scale insect is found at lower and middle elevations, but is more abundant in the lowlands.

Scale: The scale of the adult female is circular, about 2.5 to 3 mm. in diameter, white, but usually so concealed beneath the epidermis of the host that its color is obscured. (Ferns 1937, SI-65.)

Natural Enemies: The following parasitic enemies have been recorded from the coccid: the entomogenous fungus *Myrangium Duriaei* Mont. & Berk. and the aphelinid wasp, *Pseudopteratrix imitatrix* Fullaway.

Host: The coccid has been recorded from the following trees:

<i>Bixa orellana</i> L.	"achiote"
<i>Casearia arborea</i> (L. C. Rich) Urban	"rabo de ratón"
<i>Cassia fistula</i> L.	"cañafistula"
<i>Castilla elastica</i> Cerv.	"palo de goma"
<i>Casuarina equisetifolia</i> Forst.	"casuarina"
<i>Cedrela mexicana</i> Roem.	"cedro"
<i>Cedrela odorata</i> L.	"cedro español"
<i>Cestrum laurifolium</i> L'Her.	"galán del monte"
<i>Chrysophyllum cainito</i> L.	"caimito"
<i>Cupania americana</i> L.	"guara"
<i>Genipa americana</i> L.	"jagua"
<i>Gliricidia sepium</i> (Jacq.) Steud.	"madre de cacao"

<i>Guettarda scabra</i> Sw.	"prickle wood"
<i>Hymenaea courbaril</i> L.	"algarrobo"
<i>Mammea americana</i> L.	"mamey"
<i>Myrcia citrifolia</i> (Aubl.) Urban	"hoja menuda"
<i>Plumeria rubra</i> L.	"alelí"
<i>Tabebuia pallida</i> Miers	"roble"

***Diaspis boisduvalii* Signoret**

A cosmopolitan species, rare in our Island. Chiefly a greenhouse pest in temperate regions of the world, attacking palms, orchids and cacti.

Scale: The scale of the adult female is almost white, transparent, thin, flat, circular, the exuvia subcentral; the scale of the male, white, elongate and tricarinate. (Ferris 1937, SI-32.)

Host: The only tree from which this scale has been recorded in the Island is from the imported "manzana malaya", *Eugenia malaccensis* (L.).

***Pseudaulacaspis pentagona* (Targioni)**

(The West Indian Peach Scale)

A very common scale insect in Puerto Rico and in the West Indies in general. Cosmopolitan in distribution and with a considerable long list of host plants from all parts of the world. In Puerto Rico it is common in the lowlands as well as at middle and higher altitudes, going up sometimes to the 3,000 ft. mark. When abundant it is very pestiferous and capable of killing young trees and destroying branches and twigs in mature ones. (Listed in IB, p. 135 as: *Aulacaspis pentagona* Targioni.)

Scale: The scale of the female is white, subcircular, the exuvia near the margin, the first exuvium sometimes projecting; the one of the male, elongate, white and non-carinate. (Ferris 1937, SI-109.)

Natural Enemies: The aphelinid wasp. *Prospaltella diaspidicola* Silvestri has been reared from this coccid.

Host: The coccid has been recorded from the following trees in the Island:

<i>Calotropis procera</i> (Ait.) R. Br.	"algodón de seda"
<i>Clibadium erosum</i> (Sw.) DC.	"turma de toro"
<i>Erythrina glauca</i> Willd.	"bucare"
<i>Erythrina poeppigiana</i> (Walp.) O. F. Cook	"bucare"
<i>Fraxinus</i> sp.	ash
<i>Gleditsia triacanthos</i> L.	honey locust
<i>Mammea americana</i> L.	"mamey"
<i>Mangifera indica</i> L.	"mangó"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"

<i>Pariti tiliaceum</i> (L.) Hil.	"esmajagua"
<i>Salix chilensis</i> Molina	"sauce"
<i>Trema lamarckiana</i> (R. & S.) Blume	"cabrilla"
<i>Trema micrantha</i> (L.) Blume	"palo de cabra"

***Pinnaspis buxi* (Bouché)**

A species rarely seen on trees in Puerto Rico. The species is regarded as an Old World form, but it has been recorded from many parts of the New World, such as United States, Jamaica, Trinidad, Grenada, Panama, etc.

Scale: The scale of the female is about 1 mm. long, very thin, and quite translucent. The insect occurs on the leaves of the host plants. (Ferris 1937, SI-98.)

Host: Recorded from the "corozo" palm, *Acrocomia media* Cook.

***Pinnaspis minor* (Maskell)**

(The Lesser Snow Scale)

A common scale insect in Puerto Rico, found in the lowlands as well as middle elevations. The species has been recorded from Florida, Jamaica, Antigua, Grenada, Panama, Brazil, Japan, Ceylon and New Zealand.

Characteristics: The species can be distinguished by the presence of the female and male puparia on the infested trees.

Female puparium: The female puparium is opaque snowy white, often specked with brown from the incorporation of fragments of the cuticle of the bark; rather broadly dilated behind. Pellicles fulvous, the second deeply tinged with reddish brown. In fully developed individuals the second pellicle occupies a little less than one third the length of the puparium. First pellicle half length of second. Central scale thin, remaining attached to plant. Length 1.50 to 2 mm.

Male puparium: The male puparium is snowy white, narrow, with the sides almost parallel, posterior extremity slightly wider, distinctly tricarinate, the ridges even and moderately smooth. Pellicle fulvous. Length 1 mm. (Green 1899, part 2, p. 115.)

Habits: The scale insect may occur on the foliage, but seems to prefer the trunk and larger branches. When it becomes abundant the trunk looks as if painted with a white wash. This behavior is very characteristic of the species and trees like these have been observed even at 2,000 ft. in elevation.

Natural Enemies: The entomogenous fungus *Myrangium Duriae* Mont. & Berk., attacks the coccid in the field.

Host: The insect has been recorded from the following trees:

<i>Annona muricata</i> L.	"guanabána"
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<i>Annona reticulata</i> L.	"corazón"
<i>Colubrina arborescens</i> (Mill.) Sarg.	"abeyuelo"
<i>Guazuma ulmifolia</i> Lam.	"guácima"
<i>Melia azedarach</i> L.	"alilaila"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Pariti tiliaceum</i> (L.) Hil.	"esmajagua"
<i>Samanea saman</i> (Jacq.) Merrill.	"samán"
<i>Tectona grandis</i> L.	teck
<i>Thespesia populnea</i> (L.) Soland	"emajaguilla"
<i>Trema lamarckiana</i> (R. & S.) Blume	"cabrilla"
<i>Trema micrantha</i> (L.) Blume	"palo de cabra"
<i>Zanthoxylum flavum</i> Vahl	"aceitillo"

***Leucaspis indica* Marlatt**

Rare in the Island, presumably a scale insect of Indian origin. Recorded from "mango", *Mangifera indica* L., at Mayagüez, P. R.

***Aonidiella orientalis* (Newstead)**

(The Oriental Yellow Scale)

A fairly common species in Puerto Rico, also recorded from India, (its native home) Ceylon, Arabia, Australia, Florida, Cuba and the West Indies. Listed in (IB:37) as: *Aspidiotus cocotiphagus* Marlatt.

Scale: The scale of the female is quite thick, circular, flat, white to light brown in color, with the exuviae central, and the second exuviae dark brown. The scale of the male is slightly elongate oval, the yellowish exuvia near one end. (Ferris 1938, SII-180.)

Habits: This scale insect usually occurs on the foliage of the host plants, usually at low elevations in the Island.

Host: The coccid has been recorded from the following trees in Puerto Rico:

<i>Calophyllum calaba</i> Jacq.	"maría"
<i>Cocos nucifera</i> L.	"coco"
<i>Erythrina berteroana</i> Urban	"machete"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Tamarindus indicus</i> L.	"tamarindo"
<i>Zanthoxylum flavum</i> Vahl	"aceitillo"

***Aspidiotus cyanophylli* Signoret**

A common species in Puerto Rico, especially abundant in the lowlands. Also recorded from Florida, Texas, Brazil, Mexico, England, France, Ceylon and Mauritius.

Scale: The scale of the female is flat, elongate oval, whitish or gray,

exuviae central; the one of the male is similar in form, but the exuviae is near one end. (Ferris 1938, SII-237.)

Habits: The scale insect usually affects the foliage of host plants.

Host: The coccid has been recorded from the following trees:

<i>Aleurites moluccana</i> (L.) Willd.	"nuez de India"
<i>Barringtonia speciosa</i> Forst.	"coco marino"
<i>Dillenia indica</i> L.	
<i>Eugenia malaccensis</i> L.	"manzana malaya"
<i>Mangifera indica</i> L.	"mangó"
<i>Neowashingtonia robusta</i> (Wendl.) Britton	"palma del desierto"
<i>Vitex divaricata</i> Sw.	"higüerillo"

***Aspidiotus destructor* Signoret**

(The Coconut Scale)

A very common scale insect in the Island, also recorded from Florida, Mexico, the West Indies, Demerara, China, Formosa, India, Mauritius and Laccadive Islands.

Scale: The scale of the female is straw-colored, circular, flat, very thin and delicate, exuviae central and quite pale, that of the male is slightly elongate, similar to that of the female in color and texture. (Ferris 1938, SII-191.)

Habits: The scale insect is usually found infesting the foliage of the host plants. It is very abundant in the lowlands, and is seldom observed at middle or higher elevations. This scale insect is very pestiferous and when abundant it can cause damages of considerable economic importance. Dr. Wolcott's description of the behavior of this scale insect on coconut palms is herewith cited:

"The lower surface of the infested leaves are often entirely covered by its round, semi-transparent shells, yellow and opaque only in the centre. The leaf tissue underneath each young scale begins to turn yellow soon after the beak of the insect has been inserted and its saliva spread among the plant cells. Beneath a mass infestation the entire leaf is soon killed. In such cases, scale infestation only hastens the natural process of maturing and dropping of the frond." (EEWI, p. 358.)

Natural Enemies: The scale insect is attacked in the field by the larvae and adults of the following ladybird beetles: *Scymnillus nunenmacheri* Sicard, *S. variipennis* Sicard and *Scymnillodes cyanescens violaceus* Sicard, all of which are native. Recently the Agricultural Experiment Station at Mayagüez, imported several species of ladybird beetles or coccinellids from Trinidad, Cuba and Texas for the purpose of controlling the bamboo scales. Now they are feeding preferably on the coconut scales. The imported

beetles are *Cryptognatha nodiceps* Marshall, *C. simillima* Sicard, *Azya trinitatis* Marshall and *Chilocorus cacti* (Linnaeus). All these species are now well established in the Island and undoubtedly they will play an important role in the natural control of this pest.

The ladybird beetles are not the only enemies of the coconut scale insect. The aphelinid wasps, *Aphelinus chrysomphali* Mercet and *Aspidiotiphagus lounsburyi* Berleze & Paoli are also effective in the control of the pest the former being responsible for the practical control of the pest in the field.

The entomogenous fungus *Botrytis Rileyi* Farlow has been recorded as attacking this scale insect. Its effectiveness as a natural means of control is uncertain.

Host: The coccid has been reported from the following trees in Puerto Rico:

<i>Annona glabra</i> L.	"cayur"
<i>Barringtonia speciosa</i> Forst.	"coco marino"
<i>Cocos nucifera</i> L.	"coco"
<i>Grevillea robusta</i> A. Cunn.	"roble australiano"
<i>Mammea americana</i> L.	"mamey"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Phoenix dactylifera</i> L.	"dátil"
<i>Psidium guajava</i> L.	"guayaba"
<i>Terminalia catappa</i> L.	"almendra"

***Aspidiotus lataniae* Signoret**

This scale insect is not common in Puerto Rico. It has also been recorded from Brazil, Mauritius, Galapagos Islands and is frequently seen in greenhouses in Europe.

Host: Recorded from "roble", *Tabebuia pallida* Miers. and "uva de playa", *Coccolobis uvifera* (L.) Jacq.

***Aspidiotus herculeanus* Hadden**

Rare in Puerto Rico, also recorded from Cuba, Florida and Society Islands (Pacific Ocean).

Host: Recorded from "roble", *Tabebuia* sp.

***Selenaspidus articulatus* (Morgan)**

A common scale insect in the Island, also recorded from Mexico, Costa Rica, Panamá, West Indies, Brazil, West Africa and England. Originally described from Demerara, British Guiana. Abundant at lower elevations in Puerto Rico.

Scale: The scale of the female is flat, circular, white, the centrally

placed exuviae being darker; the scale of the male is almost white, oval, and with a subcentral exuvia. (Ferris 1938, SII-265.)

Natural Enemies: The scale insect is parasitized in the field by the entomogenous fungus, *Microcera Fujikuroi* Miyabe & Saw.

Host: The coccid has been recorded from the following trees:

<i>Annona muricata</i> L.	"guanábana"
<i>Annona reticulata</i> L.	"corazón"
<i>Calophyllum calaba</i> Jacq.	"maría"
<i>Chrysophyllum cainito</i> L.	"caimito"
<i>Ficus nitida</i> Thunb.	"laurel de la India"
<i>Eugenia jambos</i> L.	"pomarroza"
<i>Tamarindus indicus</i> L.	"tamarindo"

***Pseudaonidia tesserata* (de Charmoy)**

Rare in the Island, also recorded from Mexico, Cuba, Mauritius and Java.

Host: Recorded from "guamá", *Inga laurina* (Sw.) Willd.

***Chrysomphalus aonidum* (Linnaeus)**

(The Florida Red Scale)

An important pest of citrus in the Island and also in other parts of the world. The insect has been recorded from United States, Cuba, Jamaica, Barbados, Central and South America, Europe and the Orient.

Scale: The scale of the female is flat, circular, variable in color, but usually dark, the centrally placed exuviae being somewhat paler than other parts. The scale of the male is somewhat elongate oval and the exuvia is near one end.

Habits: The scale insect usually is found on the foliage of the host trees. In citrus, it also infests the fruits. In Puerto Rico this species is found at low elevations, not yet recorded at middle or higher.

Natural Enemies: The insect is parasitized by the aphelinid wasp, *Aspidiotiphagus citrinus* (Craw.).

The entomogenous fungi *Sphaerostilbe coccophila* (Desm.) Tul. and *Microcera Fujikuroi* Miyabe & Saw. are parasitic on the scale insect too, helping to keep the insect in control.

Host: The coccid has been recorded from the following trees:

<i>Annona muricata</i> L.	"guanábana"
<i>Cocos nucifera</i> L.	"coco"
<i>Ficus nitida</i> Thunb.	"laurel de la India"
<i>Ternstroemia stahlii</i> Krug & Urban	"mamey del cura"
<i>Terminalia catappa</i> L.	"almendra"

Aonidiella aurantii (Maskell)

(The California Red Scale)

A world wide distributed species, considered as a pest of citrus fruits. The species is not abundant in the Island. (In Wolcott's, IB. as *Chrysomphalus aurantii* Maskell).

Scale: The scale of the female is circular, quite flat, with the exuviae central, the scale itself thin, and pale, permitting the red-brown color of the heavily sclerotized adult female to show through. The scale of the male is elongate oval, paler in color than the female, exuvia slightly toward one end. (Ferris 1938, SII-179.)

Host: Recorded from "guanábana", *Annona muricata* L.

Chrysomphalus distyospermi (Morgan)

(The Spanish Red Scale)

A scale insect not common in the Island, also found in United States, Mexico, Central America, Brazil, British Guiana, Europe, Africa and the Orient.

Scale: The scale of the female is rather thin, flat, circular, light brown or yellowish, the exuviae central. The one of the male is elongate oval, similar in color to the female, exuvia towards one end. (Ferris 1938, SII-200.)

Natural Enemies: The scale insect is destroyed by the larvae and adults of the coccinellid beetle, *Scymnus nunenmacheri* Sicard.

Host: The coccid has been recorded from the following trees:

<i>Mangifera indica</i> L.	"mangó"
<i>Psidium guajava</i> L.	"guayaba"
<i>Swietenia mahagoni</i> Jacq.	"caoba"

Chrysomphalus personatus (Comstock)

(The Masked Scale)

A common scale insect in Puerto Rico, also listed from Mexico, British Guinea, Brazil, the West Indies and England, (in greenhouses). Usually a lowland species not observed at middle or higher elevations.

Scale: The scale of the female is black, almost hemispherical or somewhat thimble-shaped, with the exuviae central; that of the male flat, oval, lighter in color. (Ferris 1941, SIII-372.)

Natural Enemies: The scale insect is parasitized by the signiphorid wasp, *Thysanus fax* (Girault).

Host: The coccid has been recorded from the following trees:

<i>Annona muricata</i> L.	"guanábana"
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<i>Calophyllum calaba</i> Jacq.	"maría"
<i>Cocos nucifera</i> L.	"coco"
<i>Ficus nitida</i> Thunb.	"laurel de la India"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Laguncularia racemosa</i> (L.) Gaertn.	"mangle bobo"
<i>Mammea americana</i> L.	"maney"
<i>Symplocos martinicensis</i> Jacq.	"aceituna blanca"

Chrysomphalus (Melanaspis) portoricensis Lindinger

(The Cocolobis Scale)

A typically native scale insect with a very limited distribution in the Island. Possibly present in Colombia and Mexico.

Scale: The scale of the female is black, circular, high convex, with the exuviae subcentral. The scale of the male is oval, with the exuvia at one end. (Ferris 1941, SIII-364.)

Habit: The scale insect usually attacks the twigs of the host plant.

Host: The coccid has been recorded from the following trees:

<i>Cocolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Cocolobis venosa</i> L.	"calambreaña"

Chrysomphalus nigropunctatus (Maskell)

Rare in Puerto Rico, also recorded from Mexico and Panama.

Habits: The scales of the type are common to the genus, the female with the exuviae tending to be submarginal. The scale insect occurs in exposed situations, on the bark of trees or concealed beneath the bark flakes. (Ferris 1941, SIII-360.)

Host: Collected beneath bark flakes on the trunk of "guayacán" trees, *Guaiacum officinale* L., at Salinas, near the coast.

Furcaspis biformis (Cockerell)

(The Orch'd Scale)

A fairly common scale insect in the Island, particularly attacking bromeliaceous plants. Also recorded from Trinidad, the West Indies and Central America. Apparently a pest of orchids.

Scale: The scale of the female is dark, red-brown, circular, moderately convex and with a central exuviae. The male is similar in color, elongate, slender, with the exuvia close to one end. (Ferris 1938, SII-231.)

Natural Enemies: The aphelinid wasp, *Prospaltella diaspidicola* Silvestri has been reared, as a parasite of this species.

Host: The coccid has been recorded from the following trees:

<i>Mangifera indica</i> L.	"mangó"
<i>Persea gratissima</i> Gaertn.	"aguacate"

Pseudischinaspis bowreyi (Cockerell)

This scale insect is not common in Puerto Rico. It has been recorded from Brazil, Trinidad, Jamaica and Mexico.

Host: The coccid has been found attacking the following trees:

<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Spondias purpurea</i> L.	"jobillo"

Pseudoparlatoria ostreata Cockerell

(The Papaya Gray Scale)

This scale insect is very abundant in the Island and is considered as one of the worst pests of "papayas", *Carica papaya* L. It is also recorded from Jamaica.

Scale: The scale of the female is thin and papery, dark grey, exuviae subcentral. The one of the male of a similar color and texture, but elongate and with exuvia at one end. (Ferris, May 1942, SIV-416.)

Natural Enemies: This scale insect is very efficiently controlled by the twice-stabbed ladybird beetle, *Chilocorus cacti* (Linnaeus).

Host: Recorded from "higuillo de limón", *Piper amalago* L.

Pseudoparlatoria parlatorioides (Comstock)

This scale insect is not common in the Island. It has been recorded from southern United States, Mexico, Panama, the West Indies, South America, Italy and Ceylon.

Scale: The scale of the female is flat, thin and papery, of a yellowish or yellowish brown color, circular, or oval, with the exuviae submarginal. The one of the male similar in color and texture, but somewhat elongate and the exuvia at one end. (Ferris 1942, SIV-417.)

Host: The coccid has been recorded from the following trees:

<i>Amyris elemifera</i> L.	"tea"
<i>Laguncularia racemosa</i> (L.) Gaertn.	"mangle bobo"

Lepidosaphis crotonis (Cockerell)

Rare in Puerto Rico, also recorded from Jamaica, from which it was originally described.

Host: Recorded from "guaba", *Inga vera* Willd.

Lepidosaphes gloverii (Packard)

(Glover's Scale)

A species not common in Puerto Rico, but with a world wide distribution. Recorded from United States, Cuba, Mexico, Central America, South America, Africa, Hawaiian Islands and the Orient.

Scale: The scale is very similar to the related species *L. beckii* (Newman). The scale of the female is 3 mm. in length, but much more slender than in *beckii*. (Ferris 1937, SI-74.)

Host: Recorded from "guayaba", *Psidium guajava* L.

***Ischnaspis longirostris* (Signoret)**

(The Black Thread Scale)

A very common scale insect in the Island, easily identified on account of its peculiar shape and size, and different from any other scale insect present in our insular fauna. It is distributed throughout the tropical and subtropical regions of the globe.

Scale: The scale of the female is slender, filiform, reaching a length of 3 mm., black and with a terminal exuviae. The scale of the male similar. (Ferris 1937, SI-67.)

Habits: The scale insect usually occurs on the leaves of the host plants, but when abundant it also affects the twigs. Found from low elevations and up to 1,500 ft.

Host: The coccid has been recorded from the following trees in Puerto Rico:

<i>Acrocomia media</i> Cook	"corozo"
<i>Citharexylum fruticosum</i> L.	"péndula"
<i>Cocos nucifera</i> L.	"coco"
<i>Ficus nitida</i> Thunb.	"laurel de la India"
<i>Guarea trichilioides</i> L.	"guaraguo"
<i>Neovashingtonia robusta</i> (Wendl.) Britton	"Palma del desierto"
<i>Picrocarpus officinalis</i> Jacq.	"palo de pollo"
<i>Roystonea borinquena</i> Cook	"palma real"
<i>Swietenia macrophylla</i> King	"caoba de Honduras"

FAMILY ALEYRODIDÆ

This family includes the white flies or "moscas lanudas", the members of which are phytophagous in their habits. They are of little economic importance as far as forest trees are concerned. Some species infest trees and become so abundant as to give a whitish appearance to the foliage.

As the name implies the adult looks like a small fly, but with the wings and body covered with a mealy bloom giving to it a whitish appearance. The pupal stages of white flies are very similar in form and size to scale insects and are apt to be confused with them. The pupal stages of *Aleuroplatus*, for example, look very much like a soft bodied scale insect resting on the leaf of a tree. This is particularly true if no adults of the white flies are present in the vicinity.

The Puerto Rican species affecting our trees and shrubs are the following:

Aleurodicus griseus Dozier is a species fairly common in the Island. (Description of the species in IB, p. 143-4).

Host: Recorded from the following trees:

<i>Eugenia myrtilloides</i> Poir.	"anguila"
<i>Eugenia biflora lancea</i> (Poir.) Krug & Urban	"pitangueira"
<i>Myrica cerifera</i> L.	"arrayán"

Aleurodicus cocois (Curtis) is not a common species in the Island. Only has been recorded from the following trees:

<i>Cocos nucifera</i> L.	"coco"
<i>Neowashingtonia robusta</i> (Wendl.) Britton	"palma del desierto"

Aleurodicus antillensis Dozier is another of our species, not common in the Island. (Description in IB, p. 145).

Natural Enemies: The insect is parasitized by the entedontid wasp, *Eudromphale vittata* Dozier.

Host: Recorded from the following trees:

<i>Calophyllum calaba</i> Jacq.	"maría"
<i>Erythrina glauca</i> Willd.	"bucare"

Aleurodicus minimus Quaintance a pest of guavas is an abundant species in the Island.

Natural Enemies: The insects are controlled in the field by means of entomogenous fungi: *Aegerita Webberi* Fawcett, *Aschersonia Aleurodis* Webber and *Aschersonia flavo-citrina* P. Henn.

Host: Recorded from the following trees:

<i>Cestrum diurnum</i> L.	"dama de día"
<i>Psidium guajava</i> L.	"guayaba"

Aleurothrixus floccosus (Maskell) is undoubtedly our most common white fly, considered as a minor pest of citrus in Puerto Rico and attacking a few trees and other plants in the Island.

Natural Enemies: The insect is parasitized by some species of parasitic wasps: the entedontid, *Eudromphale aleurothrixii* Dozier, the aphelinid, *Encarsia basicincta* Gahan, the signiphorid, *Thysanus flavus* (Girault) and the last and possibly the most efficient of the group, the aphelinid, *Eretmocerus portoricensis* Dozier.

Host: The white fly has been recorded from the following trees:

<i>Coccolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Bursera simarouba</i> (L.) Sarg.	"almácigo"
<i>Guaiacum officinale</i> L.	"guayacán"
<i>Psidium guajava</i> L.	"guayaba"
<i>Spondias dulcis</i> Forst.	"cítara"

Aleuroplatus vinsonioides (Cockerell) is not a common species. It has

been collected several times on forest trees at lower and middle elevations.

Host: The following are the host trees of this species:

<i>Daphnopsis caribaea</i> Griseb.	"majagua de sierra"
<i>Nectandra sintenisii</i> Mez	"laurel amarillo"
<i>Ocotea leucoxylon</i> (Sw.) Mez	"laurel geo"

HEMIPTERA

FAMILY TINGITIDÆ

The members of this family are the so called lace-wing bugs, characterized by the reticulated and gauze-like structure of the hemielytra, usually accompanied by expansions of the prothorax of a similar form. Generally they are small insects, but usually very abundant. They occur in large numbers on the foliage of a few trees, especially on the undersides of the leaves, which they puncture in order to suck the plant juices. Our most common insular species are:

Corythucha gossypii (Fabricius)

This is an abundant species in Puerto Rico attacking many different kinds of plants. It is widely distributed through the southern United States, Mexico, Central America, northern South America and the West Indies.

Adult: Lightly maculated with brown. Pronotal vesicula, viewed dorsally, rather small; viewed laterally, not much elevated above the strongly elevated median carina; dorsal outline almost semicircularly rounded. The following parts spinose: lateral margins and transverse median veins of the paranota, pronotal vesicula, lateral margin of the corium, discal elevation, and some of the veins of the costal region. (Barber 1939, p. 369). (See fig. 9).

Habits: The infestation usually occurs on the undersides of the leaves, but when the insects are abundant they can be seen all over the foliage, even on the twigs. The general symptoms of presence of lacewing bugs are: first a whitening and later a russetting of the infested leaves, especially along the midrib. As the infestation progresses, many leaves will turn completely white on account of the heavy drain of the plant juices. In most cases a partial defoliation follows such attacks.

When one observes closely the infested foliage, a tremendous number of adults and nymphs are noticed walking around and feeding on the leaves. Wolcott, referring to this species says, "The adults are an eighth of an inch in length and half as wide, quite large enough to be seen with the naked eye, even tho the use of a lens facilitates noting the characteristic rounded thickenings of the grey wings, on account of which the insects are

called lacewing bugs. The eggs can be seen less readily, for they are partially inserted in the leaf tissue along the midrib or larger veins on the underside of the leaf, and are surrounded with a mass of black, gummy substance which leaves only the cap projecting, or which may sometimes almost entirely cover the cap. The just hatched nymphs are minute, and even those which are fully grown and about to moult to adult appear much smaller than the adults because lacking wings. They are green and brownish in colour, and on the underside of freshly infested leaves will be found in various stages of growth in compact clusters, often in company with several adults. Both nymphs and adults can move about readily.

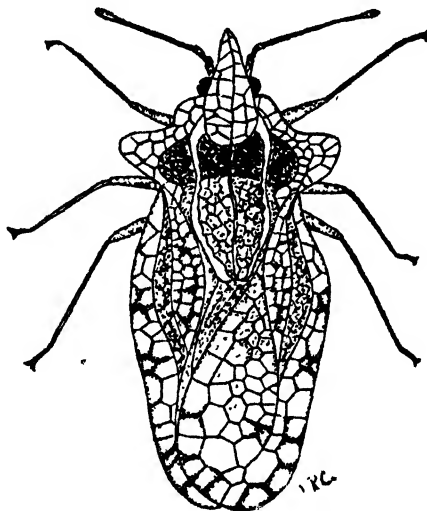


FIG. 8. *Corythaica cyathicollis* (Costa) 20X (Drawn by G. N. Wolcott).

but rarely do so unless disturbed, and while the adult can fly, and may be carried long distances by the wind, ordinarily their dispersion in a field is only to the next adjacent plants. When mass infestations develop on the plants in one corner of a field, however, dispersion is more rapid, and within a few days every plant will be found to have some adults in it. Development from egg to adult is rapid, under favourable conditions being somewhat under three weeks." (Wolcott, EEWI, p. 603-4.)

This species can be mistaken in the field with the closely related form *Corythaica cyathicollis* (Costa). At first glance they look almost alike, but on close examination many differences will be noted. (See figs. 8 and 9 for distinguishing characteristics.)

Applied Control: If a shrub or an ornamental tree is infested by this pest it can be controlled by using any commercial insecticide having as a

basis pyrethrum or rotenone, preferably the last. Usually infestation are heaviest during dry spells. Often sudden showers for days will check infestations. Sometimes a good spraying twice a day with water under high pressure will control the insects.

Host: The tingitid attacks the following trees in the Island:

<i>Annona muricata</i> L.	"guanábana"
<i>Artocarpus communis</i> Forst.	"palo de pan"
<i>Capparis baduicca</i> L.	"sapo"
<i>Capparis flexuosa</i> L.	"palo de burro"
<i>Capparis indica</i> (L.) Fawc. & Rendle	"linguam"
<i>Hernandia sonora</i> L.	"mago"

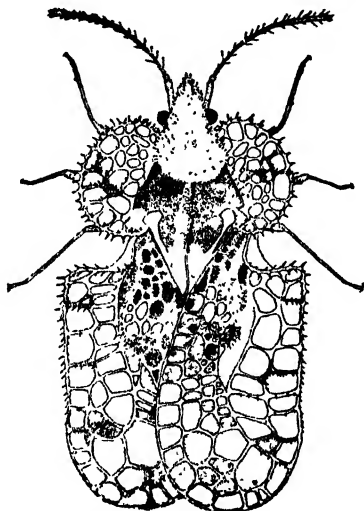


FIG. 9. *Corythucha gossypii* (Fabr.) (20X) (Drawn by F. Seña.)

<i>Isandrina emarginata</i> (L.) Britton & Rose	"vela muerto"
<i>Lonchocarpus domingensis</i> (Pers.) DC.	"genogeno"
<i>Piscidia piscipula</i> (L.) Sarg.	"ventura"
<i>Zanthoxylum caribaeum</i> Lam.	"espino rubial"
<i>Zanthoxylum flavum</i> Vahl	"aceitillo"
<i>Zanthoxylum monophyllum</i> Lam.	"mapurito"

***Leptodictya bambusae* Drake**

(The Bamboo Lacewing Bug)

This is a species with a limited distribution and not so common as the preceeding. Also occurs in Haiti (island of Hispaniola). The main characteristics of this insect are:

"Body elongate, narrow. Head with five distinct spines. Paranota with two rows of areolae, the outer margin straight. Costal area widest just behind the middle, with 3 or 4 rows of areolae. Discal area extended a little beyond middle of corium." (Barber 1939, p. 370).

"Color: Areolae transparent, slightly iridescent, the nervures yellowish white. Thorax beneath reddish brown, the abdomen testaceous. Legs testaceous, the tarsi darker. Head, eyes, and a small portion of the pronotum just back of the hood black. Bucculae and rostral laminae whitish. Antennae whitish, the third segment slightly embrowned towards the apex." (Drake 1918, p. 174).

Host: The tingitid has been recorded only from "bambúa", *Bambos vulgaris* Schrad., affecting the foliage.

***Monanthia monotropidia* Stål**

(The Capá Prieto Lacewing)

Another injurious member of the group, found in the lowlands as well as middle elevations. The main characteristics of the species are:

"Paranota narrowly turned back over the lateral margin of the pronotum, anteriorly a little wider, with a single series of areoles. The posterior C-shaped part of the discal area not so strongly outwardly as in *M. c-nigrum* Champion." (Barber 1939, p. 371-2.)

In general the insect is small, about one eighth of an inch long and of a dark brown color.

Habits: Like all the members of the family the adults and nymphs are found on the undersides of the leaves, in great numbers. When abundant they cause intense chlorosis of the leaves and usually heavy devoliation. The insect has been found in the lowlands and also at middle altitudes up to 1,500 ft. (Martorell, April 1940, p. 23).

Host: The insect is chiefly a pest of the Spanish elm or "capá prieto", *Cordia alliodora* (R. & P.) Cham., but also has been found on the foliage of "mago", *Hernandia sonora* L.

FAMILY PYRRHOCORIDÆ

***Dysdercus andreae* (Linnaeus)**

(The Cotton Stainer)

This insect is fairly abundant in Puerto Rico and is considered as a cotton pest. The insect also attacks the seeds of various trees, thus destroying a large quantity of them which otherwise might be used for propagation purposes. This species is distributed throughout tropical America: Cuba, Jamaica, Haiti, Dominica, Antigua, Guadeloupe, St. Kitts, Montserrat and Florida.

The main characteristics of the insect are the following:

Pronotum with both anterior and posterior margins narrowly pale. At least outer margin of clavus and posterior margin of corium narrowly margined with white or pale yellow. Ventral segments of abdomen posteriorly conspicuously margined with white. Hemelytra with clavus infuscated, outer margin lineate with white; corium bright red, posterior margin narrowly white, disk commonly with a black spot. (Barber 1939, p. 366).

Habits: The common name of this insect in Spanish is "unión", very well adapted to the species indeed, referring to the fact that the adults are more often noted in coitu than singly. The eggs are laid singly or in small clusters in opening bolls (in the case of cotton), in trash on the ground or in the pods of trees which they attack.

The nymphs of most species are reddish in color, tending to be gregarious in their habits. Both nymphs and adults are present together in enormous quantities in the field, especially feeding on the ground on pods and seeds of trees which they prefer.

Host: The insect affects the following trees in the Island:

<i>Ceiba pentandra</i> (L.) Gaertn.	"ceiba"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Thespesia populnea</i> (L.) Soland	"esmajaguilla"

Dysdercus sanguinarius Stål

This species which is related to the preceeding, is fairly abundant in the Island and has also been recorded from Haiti and Cuba. The main characteristics of the insect are:

Pronotum with only posterior margin narrowly pale. Hemelytra bright red, margin of clavus and corium concolorous, latter with transverse or ovate discal spot and extreme apex black; clavus with black mark of variable size. Ventral segments of abdomen unicolorous. (Barber 1939, p. 366).

Habits: More or less similar to those of *D. andreae*.

Host: The insect feeds on the pods of:

<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Thespesia populnea</i> (L.) Soland	"esmajaguilla"

COLEOPTERA

FAMILY BUPRESTIDÆ

(Metallic Wood-borers or Buprestids)

This family which in our fauna is represented by 14 species only, includes a group of insects which can be easily recognized by their metallic

coloring. Their bodies are hard and inflexible, and usually appear as if made of bronze.

Some of the adults are flower-loving, usually found in blossoms, others occur on the bark of trees, either basking in the hot sunlight or looking for a place to oviposit. They are strong fliers; some species flying very fast and with a loud buzzing noise.

The larvae of these insects are borers and feed under the bark of trees or to a lesser extent in the solid wood. They are called "flat-headed borers" because of the general shape of the cephalic and thoracic segments. The burrows of most species are flattened, thus following the general pattern of their flattened thorax. Some species of buprestids are leaf-miners, but in these the body is rather cylindrical in shape. The tree borer forms are legless, while the leaf-miners are furnished with three pairs of legs.

Some species are very injurious to forest, shade and ornamental trees. The biology of our insular forms has not been studied yet, not even that of our most common species. Only the following species have been recorded as enemies of forest trees:

***Chrysobothris megacephala* Castelnau & Gory**

(The Aceitillo Borer)

This is a fairly common insect in Puerto Rico, also recorded from Hispaniola. All specimens recorded from the Island are from the western end, particularly from the dry southwestern areas. Presumably the insect thrives best in the xerophytic forests peculiar to that region.

Adults: The male is rather elongate, moderately convex and subopaque; color uniformly dark aeneous; each elytron with four round, deep impressions, which are slightly more aureous or cupreous at the bottom; tarsi aeneo-piceous.

"The female differs from the male in having the front of head more convex and the sides feebly arcuately rounded, apex of abdomen with two semi-circular emarginations (the median tooth not as long as the lateral ones), anterior tibiae without dilatations, and the middle pair straight." Length, 9 mm.; width, 4 mm. (Fisher 1925, p. 112-13.) (See Plate II.)

Host: Adults have been reared from larvae attacking the following trees:

Agati grandiflora (L.) Desv.

"gallito"

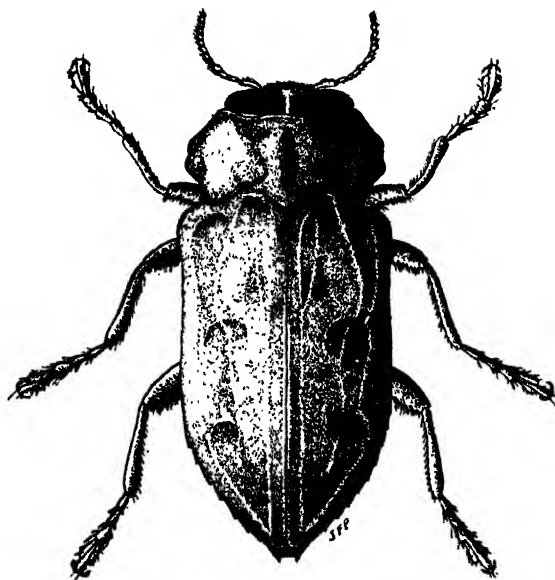
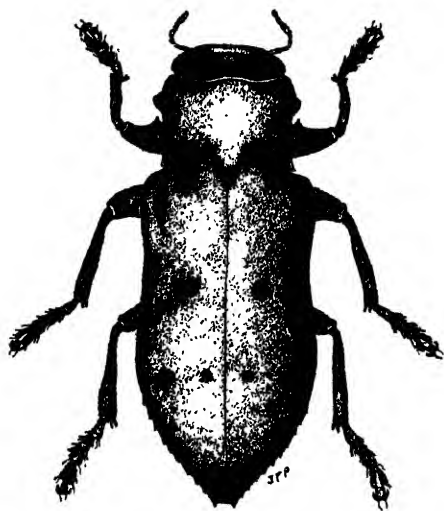
Zanthoxylum flavum Vahl

"aceitillo"

PLATE II

Chrysobothris megacephala Cast. & Gory

Chrysobothris tranquebarica (Gmelin)



(Luis F. Martorell: A Survey of the Forest Insects of Puerto Rico)

***Chrysobothris tranquebarica* (Gmelin)**

(The Mangrove Borer)

Perhaps this is our most common metallic wood-borer and also the largest species in the entire family. It has been recorded from Santo Domingo, Haïti, (Hispaniola) St. Thomas, Grenada, Guadeloupe, Bahamas and Florida. Fisher (1925 p. 96-99) gives a complete description of the species, the following being a part of it:

"Male: Form short, rather broad, and strongly depressed, subopaque; head cupreous or aeneous, with the epistoma auro-viridis; pronotum and elytra dark aeneous; each elytron with four foveae, a deep one at basal lobe, a more shallow one near humerus, a large bilobed one on disk near middle, interrupting the second costa, and an obcordate one at apical third, situated between the second and fourth costae, usually the foveae are concolorous, but sometimes the discal ones are of a lighter shade, and rarely of a reddish-cupreous color; beneath dark aeneous and more shining than above." (See Plate II.)

Female: Differs from the male in having the front of head less pubescent and the chevron on vertex more distinct, anterior and middle tibiae nearly straight, the last ventral segment of abdomen with a broad median carina at base, a depression on each side, and the apex with two shallow semi-circular emarginations, the median tooth short and the lateral ones long and acute. Length, 12-16 mm.; width, 5-7."

The life history and habits of this insect are very well discussed by Snyder (1919). From his publication the following notes are taken on the biology of this interesting borer.

Egg: The egg has the shape of a scallop shell, flattened and irregularly ribbed. It is white, ranging from 1 to 1.5 mm. in length and an average width of .75 mm. The egg hatches in about 7 days.

Larva: "The larva is white and a typical "flatheaded" borer. It is of the common *Chrysobothris* type, moderately compressed, and sparsely covered with coarse, light-colored bristles. The first thoracic segment is large and oval; the second wider and shorter than the third; the third wider than the first abdominal segment, which is narrower than the second abdominal; the third to eighth abdominal are about equal in width, the ninth and tenth successively narrower; the lateral folds of the second to ninth abdominal segments are well developed; the dorsal plate of the first thoracic segment is marked with a well developed, inverted V of grooves and pointlike rugosities; the ventral plate has a well developed groove extending back three-fourths of the distance from the anterior margin, and rugosities which tend to form ridges. The length is 30 mm. and the width of the first thoracic segment 7 to 8 mm." (Snyder 1919, p. 158.)

Pupa: The pupa is whitish or creamy in color, with the head resting on the breast and the legs and wings folded on the ventral surface. The length of the pupa ranges from 15 to 20 mm. The average duration of the pupal period is about 2 weeks.

Habits: The female lays its eggs on the bark of trees singly, in twos or threes. It is rare to find more than four of them in a row. The young larva bores in the tree and feeds on the cambium layers, making horizontal or spiral tunnels and feeding all the time until fully grown. At this stage the larva bores inside the wood and pupates. The adult gnaws its way out of the wood to the outside and then flies away. The whole life cycle from egg to adult takes about a year.

Natural Enemies: The Porto Rican petchary, *Tolmarchus taylori* (Selater) has been found to prey on this insect. Undoubtedly we must have more predators and parasites that help to keep this insect under control, but these have not been recorded yet.

Host: The following trees are attacked by the beetle in the Island:

<i>Bucida buceras</i> L.	"úcar"
<i>Casuarina equisetifolia</i> Forst.	"casuarina"
<i>Inga vera</i> Willd.	"guaba"
<i>Rhizophora mangle</i> L.	"mangle colorado"

FAMILY COLYDIIDÆ

Phloeonemus martorelli Fisher

Described from adults collected by the writer, on the gummy exudations on the trunks of "aceitillo" trees, at the Guánica Insular Forest, 200 ft. in altitude. These gummy exudations were the results of "machete" wounds produced by careless laborers while clearing the brush in the forest.

Fisher (July, 1943) on describing the insect says, "This species is closely related to *Phloeonemus haroldi* Reitter, described from Cuba, but it differs from that species in being larger, in having the longitudinal costae on the elytra not interrupted, the carinae above the eyes obtusely rounded on the tops, and the costae on the pronotum more distinct with the lateral one on each side vaguely sinuate." (Description of insect, in Fisher, 1943.)

Host: Collected and apparently not doing any damage of economic importance on the trunks of "aceitillo" trees, *Zanthoxylum flavum* Vahl.

FAMILY ANOBIIDÆ

Catorama neltumae Fisher

Abundant on the dry or xerophytic forests of the southwestern region of the Island. The insect breeds in the pods of "mesquite", a very com-

mon tree in the Guánica Insular Forest and in all the southwestern area of Puerto Rico.

Described by Mr. W. S. Fisher, as follows:

"Oblong-oval, strongly convex, moderately shining, uniformly black above, slightly more brownish beneath, with the antennae and tarsi yellowish, rather densely clothed with short, recumbent, more or less silky, whitish pubescence, which does not conceal the surface. Head and pronotum confluent punctate with fine and coarse punctures intermixed. Elytra finely, densely punctate, with numerous, irregularly arranged, coarse punctures; each elytron with two rather deep lateral striae extending from middle of elytron to apex, but obliterated basally. Anterior tibia unisulcate externally. Middle tibia without a marginal groove. Metasternum not carinate anteriorly, rather sparsely, coarsely, uniformly punctate over entire surface. Length 3.5 mm., width 2 mm." (Fisher, 1941.)

Host: Doing considerable damage to the seed pods of "mesquite", *Prosopis juliflora* (Sw.) DC.

FAMILY BOSTRICHIDÆ

Dinoderus minutus (Fabricius)

(The Bamboo Powder-post Beetle)

This small beetle commonly known as "la polilla de la bambúa" or the bamboo powder-post beetle, is a pest of bamboo, destroying the wood while it is in storage or use. The beetle may attack trees in the field, when these are dead or in a very weak condition due to the attack of other insects or pathological organisms.

The Agricultural Experiment Station at Mayagüez has been doing research for the control of this pest for the past few years. (See SIB, p. 94, for references.)

Natural Enemies: The beetles are eaten in the field by lizards, among them *Anolis cristatellus* Duméril & Bibron.

While in the course of investigations with this insect Dr. H. K. Plank found that the beetle was attacked by a reduviid bug, *Peregrinator biannulipes* Montr., which attacked and killed the adults. The reduviid fed in the following manner:

"When placed in a tube containing a number of powder-post beetles and some pieces of bamboo wood, a nymph or an adult of *Peregrinator biannulipes* almost immediately seized one of the beetles and began feeding by inserting its beak between the prothorax and mesothorax at a point to one side of the middle of the ventral portion, usually below the point where a wing cover was attached. The beetle struggled very little

and soon died. After feeding for about 30 minutes, the predator searched for another beetle and repeated the process." (Plank 1939, p. 151.)

None of the natural enemies of the beetle are abundant enough to be of economic importance as efficient means in controlling the pest.

Host : The beetles attack the "bambúa", *Bambos vulgaris* Schrad.

***Apate monachus* Fabricius**

(The Apate Borer)

A very common insect in the Island found in the lowlands and at middle elevations, boring the trunks and branches of shrubs and trees.

Adult : The adult is very easily distinguished from all other members of the family by its large size. It is dark brown to black in color and about 10 to 16 mm. long. (See illustration in IB, p. 243.)

Habits: The insect breeds in logs or in nearly dying trees, also in branches and small trunks of trees left in the fields to rot after a plantation or a forest is cleared from undesirable trees or shrubs. In the past, heavy outbreaks were recorded on coffee trees and then the insect was known as "the coffee tree borer". Really the insect does not have a preference, it breeds in dead wood and when abundant it attacks every standing tree in the vicinity whether alive or dead. The attacks on the coffee trees were undoubtedly the results of large scale breeding of this pest on slash left in the coffee groves after a clearing and trimming of the shade trees.

When an outbreak occurs the adults fly in large numbers and attack healthy trees, boring in their trunks and killing many of them. Then the females oviposit in these dying trees and the larvae emerging from these eggs live inside the wood, boring deep and long tunnels inside the hard wood. The life history of this species has not been so far studied in detail.

Applied Control: The following are means of controlling and preventing the attacks of the insect :

(1) On clearing plantations or forests, the trash of tree trunks and branches should not be left in the field. It should either be destroyed by fire or buried deep in a hole in the ground. This will prevent breeding of the insect in this dead wood.

(2) As soon as an outbreak is noticed, the insect should be controlled immediately without losing time.

(3) The only effective method of control ever used in the Island is by running a long flexible wire (No. 6 or 8) into the tunnels to kill the adults. (See Martorell. Oct. 1939, p. 25.) Although this method seems quite primitive, it works to perfection if started as soon as the outbreak is noted. Most of the females are killed and the infestation is stopped.

Host : The beetle attacks a large number of trees and the following have been recorded :

<i>Bixa orellana</i> L.	"achiote"
<i>Bucida buceras</i> L.	"úcar"
<i>Casuarina equisetifolia</i> Forst.	"casuarina"
<i>Delonix regia</i> (Bojer) Raf.	"flamboyán"
<i>Inga vera</i> Willd.	"guaba"
<i>Eugenia jambos</i> L.	"pomarrosa"
<i>Linociera domingensis</i> (Lam.) Knobl.	"hueso blanco"
<i>Melia azedarach</i> L.	"alilaila"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Picramnia pentandra</i> Sw.	"guarema"
<i>Salix chilensis</i> Molina	"sauce"
<i>Swietenia mahagoni</i> Jacq.	"caoba"
<i>Tamarindus indicus</i> L.	"tamarindo"

Heterarthron gonagrum (Fabricius)

A species which is similar in appearance to the Apaté Borer, but smaller in size and not so abundant.

Adult : The adult beetle is dark reddish brown to black in color and from 7 to 10 mm. long.

Host : The insect has been reared from only two trees in the Island : "palinguán", *Capparis flexuosa* L., and "bayahonda", *Prosopis juliflora* (Sw.) DC.

FAMILY SCARABAEIDÆ

The members of this family are the so called May beetles, June bugs or hardbacks. Our local name for the adult is "caculo", the larva being known as "gusano". The larvae or white grubs are very injurious to vegetation feeding on the roots of plants and trees. The adults when abundant are responsible for defoliation of such crops of economic importance as sugar cane, citrus and bananas, also inflicting the same damage to many species of trees. The insular species affecting forest trees are the following :

Phyllophaga vandinei (Smyth)

This is one of the largest species of *Phyllophaga* in the Island, almost identical in general appearance to *P. portoricensis* (Smyth). They differ in the sexual characters of the males and in geographical distribution. *P. vandinei* (Smyth) is restricted to the western end of the Island and its farthest occurrence being Manatí on the north coast and Peñuelas in the

south, while *portoricensis* occurs in the eastern two-thirds of Puerto Rico and also on Vieques. This insect is usually abundant at lower elevations, seldom observed at middle altitudes.

Adults: The adult is oblong, convex, broader behind, pale chestnut in color on elytra to dark reddish brown on the head, smooth and faintly shining in both sexes but not polished. Length 17 to 22 mm. The main distinguishing characteristic of the species is the male genitalia, having a collar-shaped sheath, ("theca" of Smyth) protractile, chitinous and open ventrally. The adnate armatures are distinct, chitinous and bifurcate at tip; the spicula medial and sharply deflexed ventrally. (IP, p. 102.)

Larva: The larva of this species is very similar in appearance to all others of the same group. The white grub is of the common scarabecid type; that is U-like in shape, plump, whitish with a yellow brown head bearing a pair of powerful mandibles, the thorax having three pairs of strong thoracic legs. (See Plate III.)

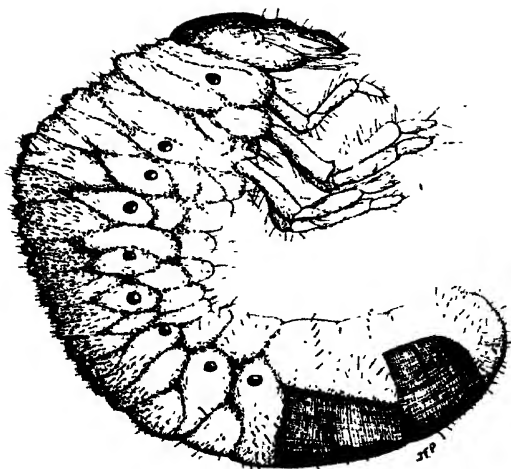
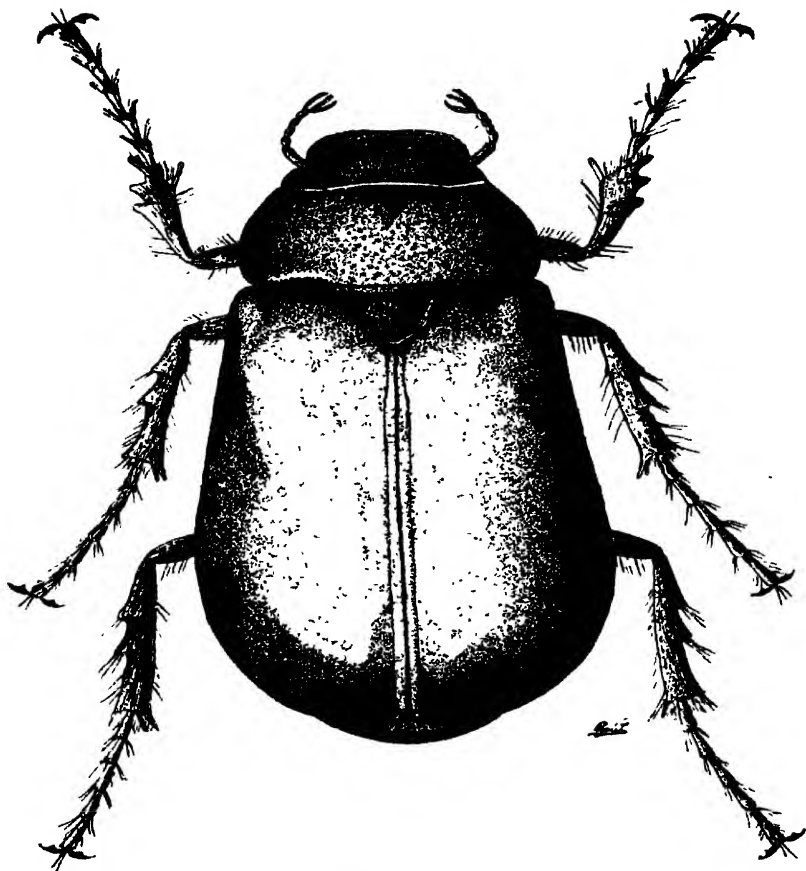
Habits: The adult female lays its eggs in the soil, and in about 14 days the larvae emerge. The young larva feeds during the first days upon the humus in the soil then changing the diet to very fine roots, feeding on this sort of food until fully grown and ready to pupate. During this larval period the immature insect goes through three instars. The first instar lasts for 36 days, the second takes 47, the third 183, at the end of which it pupates. During this last instar is when the white grub does its most intense damage, feeding exclusively on the roots of plants and trees. When fully fed and about ready to pupate, the grub digs deeply in the ground and constructs an oval cell around itself where it pupates. The pupation period lasts for about 21 days. The total life history or cycle of this species takes about a year. In Guánica, the adults are at their maximum abundance during the later part of April and August, very few being present from September to March. Great abundance of adults are usually followed after the first showers of Spring in the Guánica district.

Natural Enemies: Many are the parasites and predators which are responsible for the control of this insect in the field. Some have been introduced into the Island and others are native.

The most important factor in the control of this pest has been the imported Surinam toad, *Bufo marinus* (Linn.). Since its introduction the infestations of "caculos" have been greatly reduced, especially in the southern and southwestern districts of the Island, where the beetles caused intense depredations on the cane fields. The toads feed on the adult

PLATE III

Phyllophaga portoricensis (Smyth)
White-grub or larva of *Phyllophaga* sp.



(Luis F. Martorell: A Survey of the Forest Insects of Puerto Rico)

beetles, and when these are abundant they become the main food of the amphibian. Studies made by Dexter (1932) show that 41% of the food of toads constituted of *Phyllophaga* and *Diaprepes* adults.

Wolcott, commenting about the introduction and beneficial aspects of the toad says,

"The major factor in a changed environment for white grubs is the introduction and wide-spread dispersal of the giant toad, *Bufo marinus* (Linn.). Nearly a third of the food of this animal in cane fields consists of

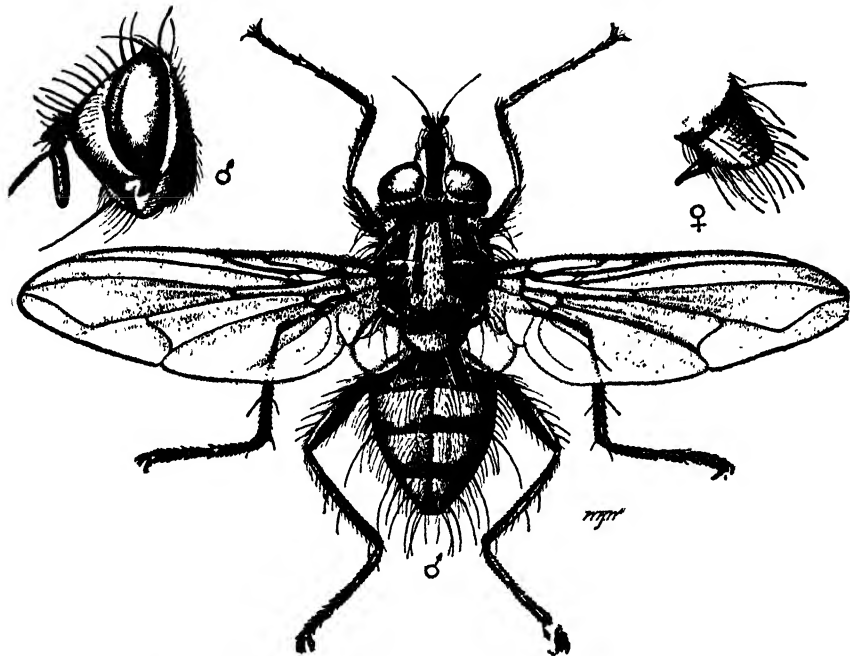


FIG. 10. *Emphanopteryx aurifacies* (Walton). Ten times natural size. (Drawn by W. R. Walton.)

May beetles, the adults of the white grubs. If the toads were comparatively scarce, as are the native toads for instance, their influence might be negligible, but as a matter of fact they are at the present time very numerous, not only along the coast, but also far up into the hillier districts of the interior. On account of their individual size, their abundance, and their preference for May beetles as food, they have rapidly changed the status of white grubs in the cane fields of the south coast, and in the agricultural regions of the Island generally, from that of a major pest to one of comparatively minor importance. (Wolcott, July 1933, p. 268.)

The larvaevorid fly *Emphanopteryx aurifacies* (Walton) (see fig. 10),

previously recorded as *Cryptomeigenia aurifacies* Walton, is a parasite of the adult beetle in the more humid parts of Puerto Rico. The fly is nocturnal in habits and deposits the eggs under the elytra of the May beetles in flight. The fly maggots pierce the integument of the beetles and feed on the internal organs, soon causing the death of those attacked. The less abundant larvaevorid fly *Eutrixoides jonesii* Walton, attacks the adults in the same fashion, also helping in the natural control of this pest.

Also playing an important role in the control of the insect in the field is a group of parasitic wasps. The tiphiid *Myzine ephippium* (Fabricius) parasitizes the 3rd. instar larva, the 2nd. instar is parasitized by *Myzine haemorrhoidalis* (Fabricius). The scoliid wasps, *Campsomoris dorsata* (Fabricius), *C. trifasciata* (Fabricius) (see fig. 11) and *C. trilineata* (Fabricius)

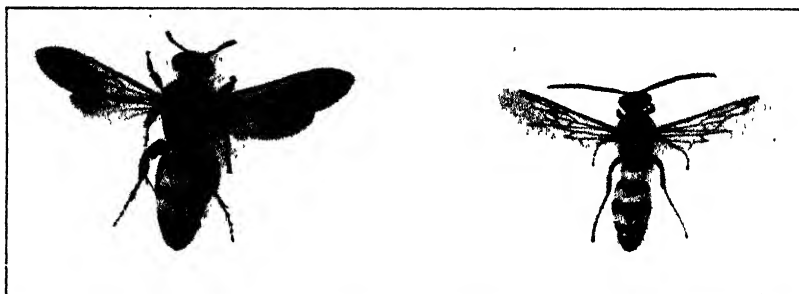


FIG. 11. *Campsomoris trifasciata* (Fabricius). One and one-fourth natural size. (Photo, H. L. Dozier). A: Female B: Male

are parasitic on the 3rd. instar larvae. A complete study of this parasitic insect was made by Box (1925).

The adults are also eaten by birds, such as the Least grebe or "tigua", *Colymbus dominicus dominicus* (Linnaeus), the West Indian killdeer or "putilla", *Oxyechus vociferus rubidus* (Riley), and the grubs by the Porto Rican thrush or "zorzal de patas coloradas", *Mimocichla ardosiacea portoricensis* (Bryant). (Danforth 1926, pp. 30, 79 and 126.)

The white grubs are also attacked in the field by the green muscardine fungus, *Metarrhizium Anisopliae* (Metschn.) Sor. However, this fungus is not efficient as a practical means of control of the grubs or adults.

Host: The adult beetles feed on the foliage of trees, often causing heavy defoliation. The following trees have been recorded:

Andira jamaicensis (W. Wright) Urban

Roystonea borinquena Cook

Sterculia apetala (Jacq.) Karst.

Swietenia macrophylla King

Terminalia catappa L.

"moca"

"palma real"

"anacaguítas"

"almendra"

"caoba de Honduras"

***Phyllophaga portoricensis* (Smyth)**

This species is considered as the eastern analogue of *P. vandinei* (Smyth) having its distribution in approximately the eastern two-thirds of the Island.

Adults: The adults are nearly the same in appearance as those of *P. vandinei* (Smyth), but they are usually larger in size, averaging 1 to 2 mm. more in length, darker in color, and the surface of their bodies somewhat more polished. However, the main difference is found in the genital structures of the males. The male genitalia has the adnate armatures spatulate at the tip instead of bifurcate; spicula roundly deflexed ventrally instead of sharply. (For illustration of adult, see plate III.)

Habits: The habits and life history are similar to those of *P. vandinei* (Smyth).

Natural Enemies: The species is controlled by more or less the same predators and parasites that control the preceding species of May beetle, but with few exceptions. The giant toad, *Bufo marinus* (Linnaeus) is at the head of the list. The third instar larva is attacked by the parasitic wasps, *Campsommeris trifasciata* (Fabricius), *C. dorsata* (Fabricius) and *C. tricincta* (Fabricius). The 2nd instar larva is parasitized by the tiphiid wasp, *Myzine ephippium* (Fabricius).

Another important enemy of this species is the larva of the "cucubano" or wireworm *Pyrophorus luminosus* (Illiger). (See figs. 12 and 13.) "One larva of the "cucubano" which transformed to adult killed and ate eight first instar white grubs, fifteen second-instar grubs, forty-two third instar grubs and three pupae of *Phyllophaga* (*Lachnosterna*) *portoricensis* (Smyth)" (IB, p. 249).

The May beetles are also attacked in the field by the fungus *Metarrhizium Anisopliae* (Metschn.) Sor. The grubs are eaten by the lizard *Ameiva cxsul* Cope.

The "múcaro", *Gymnasio nudipes* (Daudin) is the most important bird feeding on the adult beetles. The Little blue heron, *Florida caerulescens* (Latham) also feeds on the adults, but not to the extent of the "múcaro". The Porto Rican grackle, *Holoquiscalus niger brachypterus* (Cassin) feeds on the grubs. (Wetmore 1916.)

Host: The adult beetles have been found defoliating the following trees:

<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"
<i>Didymopanax morototoni</i> (Aubl.) Dene. & Pl.	"yagrumo macho"
<i>Lagerstroemia speciosa</i> (L.) Pers.	"reina de las flores"

***Phyllophaga citri* (Smyth)**

(The Citrus May Beetle)

Another species of *Phyllophaga* common in all parts of the Island with

the exception of the southwestern corner, also attacks the foliage of our trees. This species also has a one year life cycle. Its grubs are often abundant in the sandy soils of the north coast, feeding on the roots of citrus trees, while the adults feed on the leaves of citrus and other plants

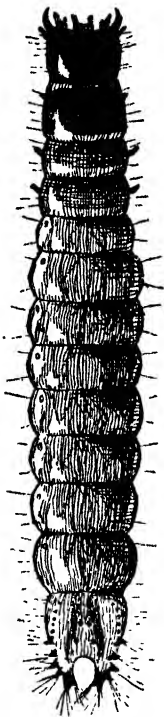


FIG. 12. *Pyrophorus luminosus* (Illiger) Larva, twice natural size. (Drawn by G. N. Wolcott.)

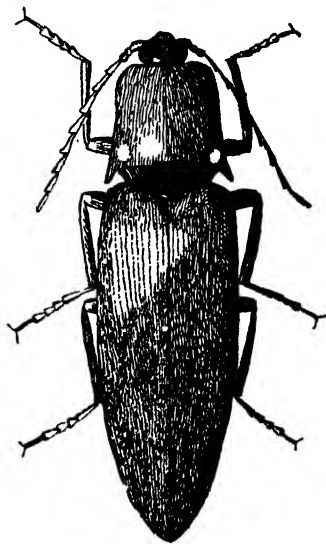


FIG. 13. *Pyrophorus luminosus* (Illiger) Adult, twice natural size. (Drawn by G. N. Wolcott.)

and trees. The main characteristics of the species as redescribed by J. D. More, are as follows:

Adults: The adult is oblong, convex, broader behind. The male is dull brown, elytra with plumbeous bloom, the female less bloom, posterior half of elytra polished chestnut brown; thorax rich mahogany brown; head darker. Length 14 to 17 mm.

The genitalia of the male with sheath collar-shaped, protractile, chitinous and open ventrally; adnate armatures fused into single spatha, spatha depressed, chitinous and polished above, unsymmetrical, hooked upwards on the left side and terminating in a serrate edge; spicula dextral. (Complete description of both sexes in IP, 103-4.)

Natural Enemies: The giant toad, *Bufo marinus* (Linn.) is the enemy number one of this beetle, recorded as feeding on the adults as well as grubs whenever they get the opportunity to find this last in the field.

The third instar grubs are parasitized by *Myzine ephippium* (Fabricius) and rarely by *Campsomeris trifasciata* (Fabricius). The second instar larva is parasitized by *Myzine haemorrhoidalis* (Fabricius).

The beetles are eaten by the lizard, *Anolis cristatellus* Duméril & Bibron and the white grubs are attacked by the fungus, *Metarrhizium Anisopliae* (Metschn.) Sor. Wolcott also cites the owl and the larva of the "cucubano", *Pyrophorus luminosus* (Illiger) as enemies of this species. (EEWI, p. 463.)

Host: The adults attack the foliage of the following trees:

<i>Grevillea robusta</i> A. Cunn.	"roble australiano"
<i>Miconia racemosa</i> (Aubl.) DC.	"camasey racemoso"
<i>Psidium guajava</i> L.	"guayaba"

***Phyllophaga guanicana* (Smyth)**

This species has a limited distribution in the Island, being confined to the southwestern corner. It is similar in appearance to *citri*. The species as redescribed by J. D. More is as follows:

"Elytra of the female polished chestnut brown with sometimes a trace of bloom. Length 13 to 17 mm. Elytra sparsely ciliate becoming more dense along the lateral margine. Pygidium densely but closely ciliate. Male with adnate armatures of genitalia fused into single spatha, spatha thicker vertically than horizontally, bilaterally symmetrical, fleshy with the exception of the two rows of minute, prostrate spinules on the dorsal and ventral surfaces". (IP, p. 104-5.)

This species is very rare and not enough studies have been made on its habits.

Natural Enemies: The only recorded enemy of this insect is the green muscardine fungus, *Metarrhizium Anisopliae* (Metsch.) Sor.

Host: The adult has been recorded as feeding on the foliage of the following trees:

<i>Bucida buceras</i> L.	"úcar"
<i>Psidium guajava</i> L.	"guayaba"
<i>Varronia angustifolia</i> West.	"basora"

***Strataegus quadrioveatus* Palisot de Beauvois**

(The Coconut Rhinoceros Beetle)

A common scarabaeid in Puerto Rico, distributed over the entire Island, presumably present in Vieques, Culebra and Mona. The insect has been also recorded from Hispaniola. It is the largest species of scarabaeid

in Puerto Rico and it could only possibly be confused with the related species *S. barbigerus* Chapin.

Adult: The adult of the coconut beetle is distinguished from that of the sugar cane rhinoceros beetle, *S. barbigerus* Chapin, by its much larger size and more highly polished surface, also by the longitudinal row of punctures present in the smaller species. In the male of this species, the anterior horn is never divided at the tip, whereas in the other species (*barbigerus*) it shows a strong tendency to divide into two short prongs.

Habits: The eggs which are laid in the soil, hatch within 20 days. The young larva grows fast and attains a size not comparable to that of any other scarabacid larva in the Island. It goes through three instars, with an average length of 39 days for the first, 71 for the second and 275 for the third. It has been determined that the total life cycle for the species is around 454 days or 15 months.

The grub or larva only feeds upon decayed wood or partly rotted coconut fiber. It is the adult beetle which does the damage and kills coconut palms, by eating the succulent tissue of the trunk of palms. It is remarkable how these beetles can tear their way into the tough, woody stem of a living coconut palm, by boring inside using their powerful barbed legs and mandibles.

Natural Enemies: The most important enemy of these beetles is the mongoose, *Herpestes birmanicus* Thomas, which consumes a great amount of adults.

The Puerto Rican grackle or "mozambique", *Hololoquiscalus niger brachypterus* (Cassin), is most efficient in destroying the larvae when they are turned by the plows in the fields under cultivation.

The green muscardine fungus, *Metarrhizium Anisopliae* (Metschn.) Sor., also attacks the insect, both the adult and immature stages. The stage most susceptible to attack by the fungus seems to be the pupa; that least susceptible the egg. (Complete discussion about this insect, in Smyth, E. G. 1920.)

Host: The adults attack the roots and trunks of the coconut palms. *Cocos nucifera* L.

FAMILY CERAMBYCIDÆ

(Long-horned Beetles or Cerambycids)

A fairly large family of the Coleoptera, represented in our Island by sixty-nine species. The beetles are of small, medium or large size, with an elongated body, often cylindrical. The antennae are long, usually longer than the whole body, thus giving origin to its common name.

The larvae are borers and attack all sorts of trees and woody plants,

some species living in the solid wood and others under the bark. The larval stages of most species are long, sometimes taking two or three years, while the pupal stages are comparatively short, lasting only few days or weeks.

The life history of many of our insular forms has not been studied yet. We really know very little about the habits of the different species. All that we know so far is the exact host trees of the species that we have been lucky enough to rear from infested material collected in the field.

The Puerto Rican forms affecting our trees are the following:

Stenodontes bituberculatus (Beauvois)

This is a large reddish brown to dark, shiny, cerambycid, measuring from 45 to 57 mm. in length. Undoubtedly it is one of our largest species in the family. It possesses long and powerful mandibles by which it can bore its way out of the trunk of trees.

Host: The insect has been found attacking the following trees:

<i>Guazuma ulmifolia</i> Lam.	"guácima"
<i>Melicocca bijuga</i> L.	"quenepa"

Derancistrus thomae (Linnaeus)

A fairly large dark reddish brown beetle, with yellowish margins on the elytra. (See Plate IV.)

The larva has been reared from "achiote", *Bixa orellana* L.

Chlorida festiva (Linnaeus)

(The Mango Borer)

A common species in Puerto Rico, collected in the lowlands as well as at middle elevations.

Adult: The adult beetle has green elytra, bordered by yellow, legs yellow to brown, thorax yellow or reddish brown with brown markings. (See Plate V.)

Natural Enemies: The adults are eaten by birds, such as ani or "judío", *Crotophaga ani* (Linnaeus).

This species is usually associated with the presence of uropodid mites, whose nymphs cling to the thorax of the beetles.

Host: The larvae of this species have been found attacking the following trees:

<i>Albizia lebbek</i> (L.) Benth.	"amor platónico"
<i>Casuarina equisetifolia</i> Forst.	"casuarina"
<i>Mangifera indica</i> L.	"mangó"
<i>Stahlia monosperma</i> (Tul.) Urban	"cóbana"

Elaphidion irroratum (Linnaeus)

This is a fairly common species in Puerto Rico and Mona Island, the adults often collected at lights.

Adult: The adult is shiny dark brown, head, thorax and elytra mottled by gray, legs and antennae reddish brown. Length 15 to 20 mm.

Natural Enemies: The larvae of the elaterid *Chalcolepidius silbermanni* Chevrolat prey upon the larvae of this cerambycid.

Host: Adults and larvae breeding in the trunk of dead "amor platónico" trees, *Albizia lebeck* (L.) Benth.

Elaphidion nanum (Fabricius)

Another common species in the Island, also recorded from Hispaniola. The adults are often collected at lights.

Adult: The adult is chestnut brown in color, body, antennae and legs covered with a grayish pubescence, the elytra appears as if it has a longitudinal stripe running on the middle of each elytron from the thorax to nearly the apex.

Host: The insects have been reared from the larvae attacking the trunk of "casuarinas", *Casuarina equisetifolia* Forst.

Elaphidion spinicorne (Drury)

A species collected in Puerto Rico and Mona Island, especially abundant at lights on Mona.

Adult: The adult is light reddish brown, with the elytra mottled with brown markings. Length 15 to 20 mm.

Natural Enemies: The larva of the elaterid *Chalcolepidius silbermanni* Chevrolat preys upon the larva of this cerambycid.

Host: Infestations on the trunk of "amor platónico" tree, *Albizia lebeck* (L.) Benth, at Ponce.

Elaphidion tomentosum Chevrolat

Perhaps not so abundant as the other species in the genus.

Host: Larva reared to adult, in "cupey", *Clusia rosea* Jacq.

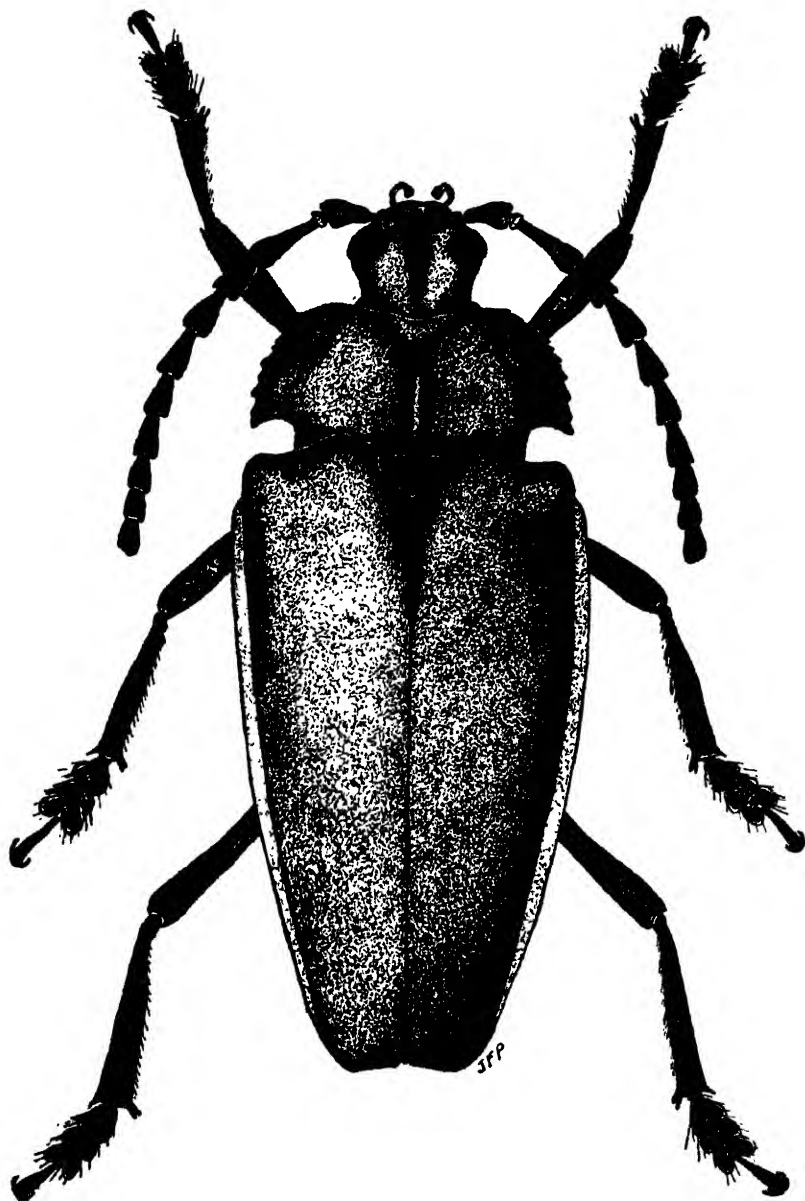
Stizocera vanzwaluwenburgi Fisher

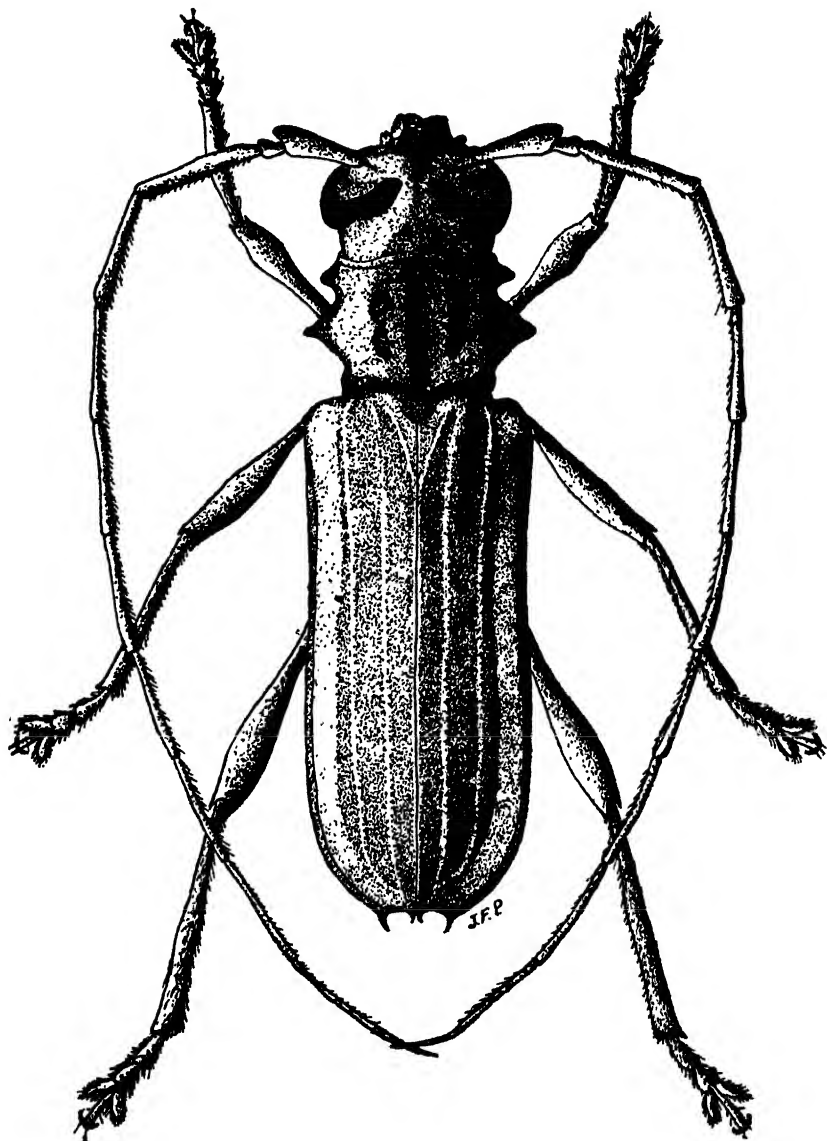
(The Roble Borer)

Not a very common species in the Island. The adults are shiny light reddish brown and from 11 to 15 mm. in length.

PLATE IV

Derancistrus thomae (Linnaeus)





Host: The writer observed heavy infestations in the trunks of "roble" trees, *Tabebuia pallida* Miers, which were used as beams for supporting the zinc roof in a cow barn at Trujillo Alto, Oct. 1935. On approaching these infested beams a funny squeaking noise was heard, apparently produced by the adults or the larvae while working in the wood. Presumably these trunks were infested in the field.

***Cylindera flava* (Fabricius)**

A common species in Puerto Rico and Mona Island, often collected at lights.

Adult: The adult beetle is rather small in size, ranging from 4 to 9 mm. in length, shiny, pale brown in color.

Host: The adults have been reared from larva infesting trunks and logs of the following trees:

<i>Bucida buceras</i> L.	"úcar"
<i>Casuarina equisetifolia</i> Forst.	"casuarina"
<i>Coccolobis urifera</i> (L.) Jacq.	"uva de playa"

***Euryscelis suturalis* (Olivier)**

A species not common in the Island, the adults collected sometimes at lights and also reared from logs of *Prosopis juliflora* (Sw.) DC., our common "bayahonda".

***Neoclytus araneiformis* (Olivier)**

A fairly common insect in the Island, collected at lower and middle elevations.

Adult: The adult beetle is black, with reddish brown markings and greyish pubescence forming a definite pattern on the elytra, very characteristic of the species.

Host: The females have been observed ovipositing on freshly-cut logs of *Inga vera* Willd. and the adults have been reared from larvae collected on logs of "úcar", *Bucida buceras* L.

***Lagochirus araneiformis* (Linnaeus)**

(The Almácigo Borer)

One of our most common species of cerambycid, collected in the lowlands as well as in middle altitudes.

Adults: The adult beetle has the elytra and thorax with markings of different shades, grayish to brown and dark brown, these varying very

PLATE V

Chlorida festiva (Linnaeus)

much in the same species, among different individuals. (See Plate VI, fig. 4.)

Habit: Very little is known about the life history of this insect, except that it attacks a tree of the genus *Bursera*. The larva feeds in the woody trunk, boring a series of tunnels. When it is nearly full grown it comes to the cambium layers close to the bark, and while there by chewing towards the outside makes a sort of a circular incision, thin enough not to go through the bark on the outside, but yet fragile enough to permit the adult beetle escape without difficulty. The larva then constructs a cell under the bark where it pupates and when the adult is ready to emerge this circular incision is opened as if it were a trap door. Infested trunks show many of these trap doors, which at first were the cause of investigations by Mr. Willis R. Whitney of Schenectady, New York. (See Whitney 1942.) (See Plate VI, fig. 3.)

Natural Enemies: The larvae of this cerambycid beetle are attacked by the larvae of the introduced, non-luminous elaterid *Chalcolepidius silbermanni* Chevrolat. The larva of this elaterid is very similar in appearance to that of the "cucubano", *Pyrophorus luminosus* (Illiger) which preys on white grubs. (See Plate VI, figs. 1 and 2.)

This predaceous insect was discussed by Wolcott & Martorell, (Jan. 1942) and from that article the following is cited:

"The luminous spots on the prothorax of the "cucubano" are sharply defined even in the pupa. The larva, however, is luminous generally in the prothorax, and slightly so on the rear edge of following segments. The elaterid larvae from the "almácigo" log, so closely resembling "cucubano" larvae morphologically, are not luminous at all, even when repeatedly stimulated in a photographic darkroom. Dr. W. H. Anderson, of the U. S. National Museum, to whom material was submitted, notes that the "cucubano" larvae are separable from them also "on the shape and ornamentation of the ninth abdominal segment, on the structure of margin of nasale and on the sculpture of dorsal surface of head". Reared to adult they proved to be *Chalcolepidius silbermanni* Chevrolat, a large non-luminous elaterid, dark-chocolate brown in color, with deeply furrowed elytra, until recently not known to exist in Puerto Rico".

Host: The larva of the cerambycid attacks only one tree in Puerto Rico, as far as the writer has been able to observe: "almácigo", *Bursera simarouba* (L.) Sarg.

PLATE VI

FIG. 1. Adult *Chalcolepidius silbermanni* Chevrolat.

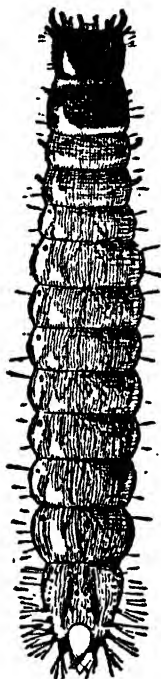
FIG. 2. Larva of "cucubano" *Pyrophorus luminosus* (Illiger) predaceous on white grubs.

FIG. 3. Log of "almácigo" *Bursera simarouba* showing exit holes of *Lagochirus*.

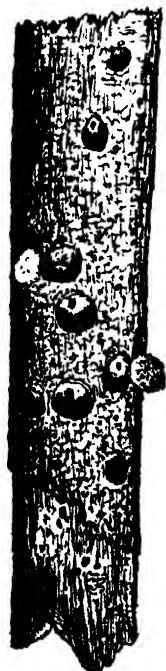
FIG. 4. Adult *Lagochirus araneiformis* (L.)



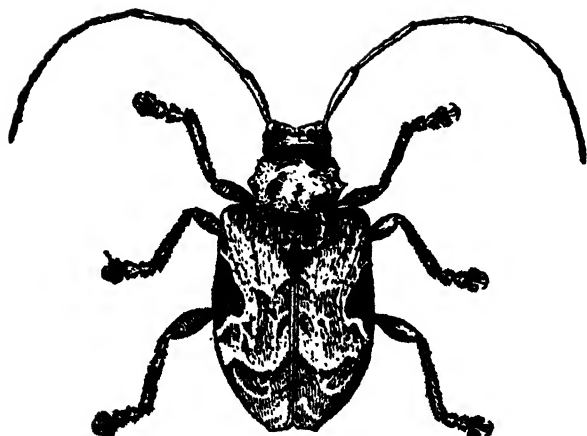
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Leptostylus argentatus Jacq. Duval

A common cerambycid in Puerto Rico, rather small, the body covered with a grayish pubescence forming a definite pattern on elytra and thorax. Length, 7 to 10 mm.

Host: Reared from larvae attacking the trunk of "aceitillo" tree, *Zanthoxylum flavum* Vahl.

Lepturges guadeloupensis Fleutiaux & Sallé

This is one of our smallest species of cerambycids, rather common in the Island.

Adult: The adult beetle is dark reddish brown, with the body covered by a grayish brown pubescence, thus giving a mottled appearance to the elytra and thorax. Antennae filiform, delicate, and about three times as long as the body.

Natural Enemies: The adult beetles are eaten by the Porto Rican tody, *Todus mexicanus* (Lesson) and also by the common lizard, *Anolis cristatellus* Duméril & Bibron.

Host: The adults have been reared from pods of "aroma" *Vachellia farnesiana* (L.) Wight & Arn., and also from dry branches of "palinguán", *Capparis flexuosa* L. Adults have been collected on branches of "mangle colorado", *Rhizophora mangle* L.

FAMILY CHRYSOMELIDÆ

This family includes the so called flea-beetles, leaf-beetles or chrysomelids. It is represented in Puerto Rico by quite an extensive number of species, some of which attack the foliage of trees, although not causing injuries of economic importance. The biology of our insular species has not been studied yet. Only the most common forms will be listed here, with their respective host trees.

Cryptocephalus tristiculus Weise

A common species in the Island, recorded as feeding on the foliage of "guaba" *Inga vera* Willd. and "almendra", *Terminalia catappa* L.

Cryptocephalus nigrocinctus Suffrian

Our most common species in the genus, attacking a large group of plants and trees. Very polyphagous in its habits.

Host: The adult beetles have been recorded from the following host trees:

Chrysobalanus icaco L.

"icaco"

Coccolobis uvifera (L.) Jacq.

"uva de playa"

Cordia borinquensis Urban

"muñeca"

<i>Dalbergia ecastophyllum</i> (L.) Taub.	"palo de pollo"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Ochroma lagopus</i> Sw.	"guano"
<i>Psidium guajava</i> L.	"guayaba"
<i>Rhizophora mangle</i> L.	"mangle colorado"
<i>Salix chilensis</i> Molina	"sauce"

Cryptocephalus perspicax Weise

A common species in the Island, quite different from the preceding which is bluish black or nearly black in color, while this is bright yellow with prothorax and elytra light brown with large yellow spots.

Host: Feeds on the foliage of the following trees:

<i>Coccolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Dalbergia ecastophyllum</i> (L.) Taub.	"palo de pollo"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"

FAMILY BRUCHIDÆ

(Pea-weevils or Bruchids)

The members of this family are small beetles, weevil-like in appearance, the head of the adults prolonged into a broad beak and the wing-covers or elytra rather short, leaving the tip of the abdomen always exposed. The larvae are usually found attacking the seeds of leguminous plants as well as others like the seeds of certain tropical palms. The local name for the adult of this insect is "gorgojo". Some of our insular species are very injurious to the seeds of trees. The following are the species affecting our trees:

Acanthoscelides dominicanus (Jekel)

This common species of bruchid has been found in the pods of different trees, feeding in the seeds and causing the total destruction of the infested pods.

Host: Reared from the pods of the following trees:

<i>Hymenaea courbaril</i> L.	"algarrobo"
<i>Prosopis juliflora</i> (Sw.) DC.	"bayahonda"
<i>Vachellia farnesiana</i> (L.) Wight & Arn.	"aroma"

Amblycerus martorelli Bridwell

A common species in the southern and southwestern districts of Puerto Rico, where its host tree grows best. Also recorded from Haiti and the Dominican Republic.

Described by Mr. J. C. Bridwell of the U. S. National Museum (Bridwell, 1943) as follows:

"Nearly the size and habits of *Amblycerus robiniae* (Fabricius) (= *Spermophagus haffmanseggi* of the Leng Catalogue not of Gyllenhal) but lacks the black integumentary areas of that species, is smaller, and has differently shaped pronotum and scutellum, shorter calcaria and numerous differences in sculpture. Reddish brown with appressed pubescence, uniformly yellowish cinereous above and pale beneath, nearly evenly disposed and partly concealing the surface sculpture, without blackish hairs except for single black hairs in the larger punctures of pronotum and elytral intervals. Pectus often infusate, sternites with ill-defined paler margins.

"Length, 5-6, width, 3-5. mm.

"Eyes emarginate for about one-fourth their length, coarsely faceted, strongly convex, projecting about one-half their width; front at clypeus separating the eyes by about one-half their width, strongly punctulate, without coarser punctures, with only a slight vestige of a glabrous unpunctured line near clypeus, mentum without punctures. Antennae with 3 narrow joints at base, joints 2 and 3 together about as long as 1 joint and longer than 4, joints 4-10 longer than broad, compressed and expanded with inner apical angles produced, these joints sub serrate and closely applied to each other.

"Prothorax about as broad at base as the elytra, transverse, dorsum coarsely and rather densely punctured on the sides, a broad longitudinal median area without these punctures, impressed lines along lateral margins above and below ending far from the anterior margin, flanks without coarse punctures; prosternum very narrow between the coxae, extending slightly beyond them, slightly expanded and truncate at apex, not received in any special structure of mesosternum; this nearly vertical, flat, hairy, and truncate at apex, meeting metasternum at an obtuse angle; metasternum not gibbous, with apex set off by the impressed marginal line; scutellum parallel sided, oblong-subquadrate, pointed at apex, emarginate on either side of the point, the lateral angles rounded.

"Elytra about thrice as long as prothorax, widest near middle, broadly, obliquely, subtruncate separately rounded at apex, intervals 2, 4, 6 and 8 slightly costate giving a slight vittate effect, intervals dotted with fine darkish punctures each bearing a single black decumbent hair. Pygidium nearly plane, oblique, about as broad as long, margins converging in a convex curve to the broadly truncate or rounded apex, disc infusate, margins pale, a pale pubescent longitudinal line, punctured except for a small subbasal area on either side. Last sternite longer than the preceding in female, shorter than preceding in male.

"Hind coxa with about 30 irregularly disposed, rather coarse shallow

punctures on the large pubescent area and with several fine strongly impressed punctures on the glabrous shining area near the insertion of the trochanter. Inner and outer carinae of ventral margin of hind femur obsolescent on basal half, inner carina unarmed as is usual in *Amblycerus*. Calcaria of hind tibia but little unequal, as 5 to 4, longer outer calcar not half as long as basal tarsal joint; outer dorsal surface of hind tibia with a line of closely placed punctures extending from base to apex, ventral surface with two lines of punctures where it meets the outer and inner faces in an even curve, apex obliquely truncate with about five rounded teeth at dorsal apex." (More information in Bridwell, 1943.)

Habits: Presumably the insect attacks the pods in the field, while they are still on the tree. The larva breeds inside the pods, feeding on the seeds and causing tremendous damages. A large percentage of the seed pods of the host tree are useless due to the intense attack of the beetle. The insects keeps on reproducing and breeding even when the seed is kept in storage. (See Plate VII, for illustration of adult.)

Host: Only recorded from the seeds of "bayahonda", *Prosopis juliflora* (Sw.) DC.

FAMILY CURCULIONIDÆ

(The Curculios, Snout-beetles or Weevils)

This family comprises a large group of insects chiefly characterized by the prolongation of its head into a well defined beak, which is usually long and curved downward. The same as the members of the preceding family these are locally called, "gorgojos".

Some species are injurious to our trees, either by attacking the seeds, roots, or causing extensive defoliation. The members of the family injurious to forest, shade and ornamental trees are the following:

***Attelabus coccolobae* Wolcott**

(The Sea-grape Leaf-roller)

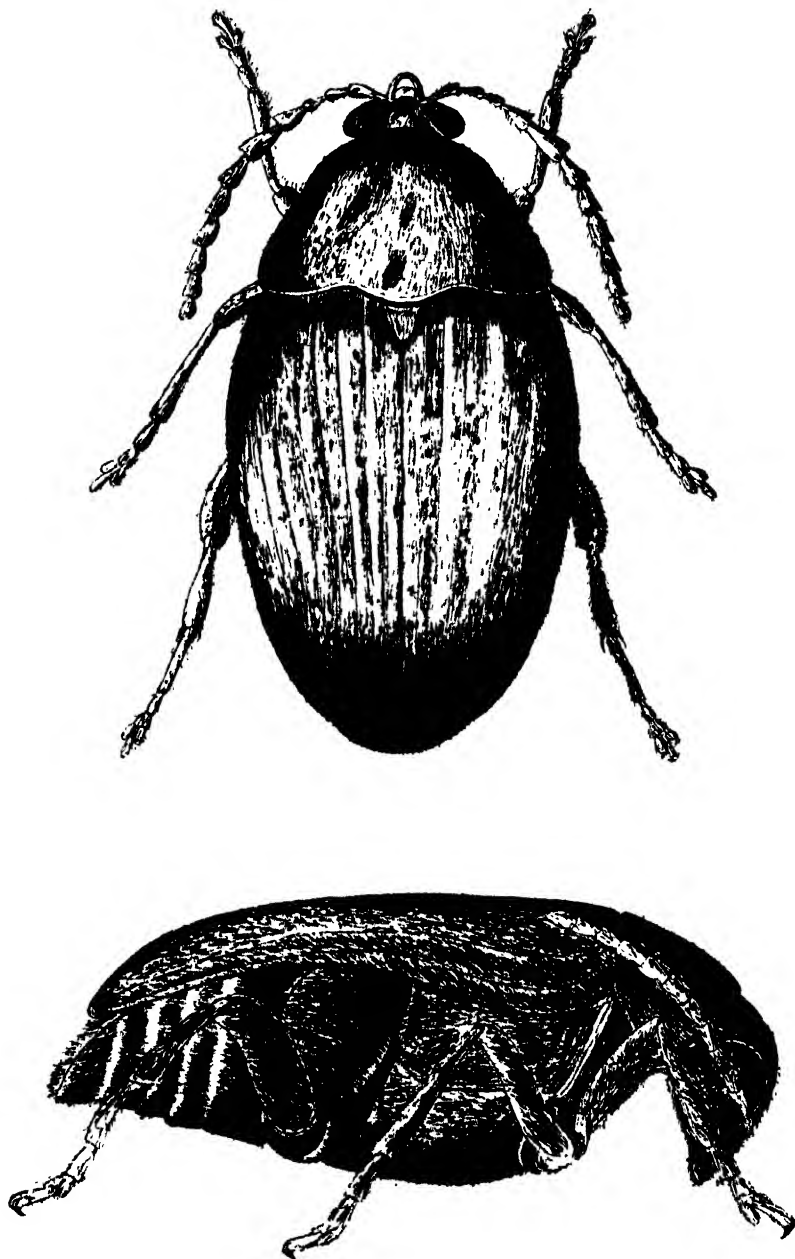
A common insect in the Island, also recorded from St. Thomas, abundant in the lowlands where most of the host trees grow, but also present at middle elevations up to 2,000 ft.

Adult: The adult is shining, robust, dark purplish red in color, tending to become dark bronze green especially in the more heavily chitinated

PLATE VII

Amblycerus martorelli Bridwell
(dorsal view)

Amblycerus martorelli Bridwell
(side view)



(Luis F. Martorell: A Survey of the Forest Insects of Puerto Rico)

portions of the male. The basal half of the median and posterior femora light yellowish brown, apical half in female and tarsi of both sexes light reddish brown. (Complete description of the species in (IP, 123-4)).

Habits: The first pair of legs of the insects in this genus (*Attelabus* Subfamily Attelabinae) are specialized for rolling the leaves. During plain daylight and in midst of the warmest hours of the day one can see the female of the species rolling the leaves of the sea-grape tree. First she cuts a strip of about 3 inches long and one-half inch in width along the edge of a leaf. With the help of the heat of the sun (which wilts the leaf) and its first pair of legs the strip is folded lengthwise just by the middle, then it is rolled and at the same time the outer edges are folded towards the inside of the roll. When the strip is about one-third rolled, the female lays an egg in the middle of the roll and keeps on rolling, at the end of which a compact, small and cylindric roll is obtained. During this operation the male acts as a spectator. Later on, the egg hatches and the young larva feeds on the leaf tissues of the inside of the roll, later changing to pupa and then completing its transformation to adult. Sometimes several of these rolls are observed in a single leaf. (Wolcott 1922, p. 6.)

Host: The beetle has been recorded from the foliage of the following trees:

<i>Coccolobis grandifolia</i> Jacq.	"moralón"
<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"

***Attelabus sexmaculatus* Chevrolat**

(The Guava Leaf-roller)

Another interesting member of the subfamily Attelabinae, very abundant in Puerto Rico at lower and middle elevations. The insect was described originally by Mr. August Chevrolat as follows:

"Assez semblable à l' *A. carneus* Er., d'un brun de poix luisant, les quatre pattes postérieures, les tarsi antérieurs, et sur chaque élytre, trois taches arrondies, jaunes; cuisses antérieures renflées; jambes antérieures dentelées sur la tranche interne. Prothorax rebordé en avant et en arrière, transversalement sillonné au milieu. Long. 5 mill. larg. 3 mill." (Chevrolat 1876, p. 228.)

The main difference between this species and the preceding is the presence of six golden dots on the elytra, that is, three on each elytron. Also exists what can be called host specificity in the two species. *A. coccolobae* Wolcott will invariably be found on trees of the genus *Coccolobis*. If the species is in any other tree the best indication is that it is not *coccolobae* but *sexmaculatus*. In general appearance and color both species are nearly the same.

Habits: The insect has the same habits of rolling the leaves and laying the egg in the roll as the preceding.

Natural Enemies: The maternal cares and precautions of the female in laying her egg well inside the roll are not enough apparently, because a small parasitic wasp, the trichogrammid *Poropoea attelaborum* Girault always finds its way to parasitize the egg.

Host: The insect has been found rolling the leaves of several trees. The last record on "almendra" is not very clear, supposedly the adult was collected while resting on a leaf, not necessarily rolling the leaf.

This insect has been recorded from the following trees:

<i>Eucalyptus citriodora</i> Hook.	"eucalipto"
<i>Eucalyptus robusta</i> Smith	"eucalipto"
<i>Psidium guajava</i> L.	"guayaba"
<i>Terminalia catappa</i> L.	"almendra"

***Apion martinezi* Marshall**

(The Aceitillo Seed Weevil)

This weevil is abundant on the southern and western sections of the Island, where its host tree is found. The economic importance of this species is tremendous, on account of the total destruction of the "aceitillo" seeds. This being one of our most valuable trees, it has been tried to be propagated by seeds, but the attacks of the weevils are so intense, that no sound seed can be collected for propagating purposes. The insect was described as *Apion xanthoxyli* by Sir Guy A. K. Marshall. (Not to be confused with *Apion xanthoxyli* Fall from Texas.) The original description of the species is as follows:

Adults: "Male, female. Derm red-brown, the head and rostrum with sparse yellowish scaling above; prothorax with fairly dense yellowish-brown scaling (sometimes varying to greyish) dorsally, which does not entirely conceal the integument, the lower surface with much denser whitish scaling; elytra with yellowish-brown scaling more or less interspersed with grey or whitish scales, and with a large common oval transverse patch of dark brown and fulvous scales in the middle of the disk, which is surrounded by an indefinite border of whitish scales; underside with rather dense yellowish or whitish scaling, but bare in the middle of ventrites 3 and 4.

Head shallowly impressed transversely behind the eyes; the forehead a little narrower than the base of the rostrum, finely rugulose; the eyes strongly convex and coarsely faceted. Rostrum as long as the pronotum, slightly curved, constricted at the base, moderately stout, angulated above the antennae, parallel-sided in the apical half, shallowly rugulose in male.

more finely punctate but otherwise similar in female. Antennae ferruginous; joint 1 of the funicle subglobular and its apical half with dense white scaling, the remaining joints with stiff white erect setae, 2 and 3 longer than broad, 4-7 transverse, 7 the widest; the club broadly ovate, with long fine erect setae. Prothorax as long as broad, subconical, widest at the base, which is deeply bisinuate, strongly narrowed to the apex, with the sides almost straight, but with a shallow subapical constriction; the dorsum highest at the base and sloping steeply forwards, forming a continuous line with the steep anterior declivity of the elytra, with shallow fine punctation, which is partly concealed by the setiform scales. Scutellum small, almost an equilateral triangle, bare. Elytra short and broad, with the shoulders very prominent; the dorsal outline extremely convex, highest at about one-third from the base and sloping almost steeply in front as behind; the striae deep but narrow, with rather shallow catenulate punctures which are mostly hidden by the scaling; the intervals flat, much broader than the striae, with fine shallow confluent punctation; the scales elongate, those on the disk narrower than the lateral ones. Legs stout, ferruginous, with fairly dense pale scaling; the claws stout, divaricate, black. Length 2 mm., breadth 1.1 mm. (Marshall 1934, p. 629-30.)

Habits: The habits of this species are unknown yet. The seeds collected in the field show an enormous percentage of infestation by the weevil larvae. Sometimes 40% of the seeds are infested, but the writer has been able to see nearly total infestation by this weevil, in seeds collected at the Guánica Insular Forest. The insect thrives as well in the lowlands or at middle altitudes and higher elevations up to 3,000 ft.

Natural Enemies: The parasitic wasp *Emersonopsis* sp. is the only insect so far recorded as enemy of this weevil. From a small amount of seeds a good series of these parasites were reared, but the percentage of parasitism has not been determined so far.

Host: The weevil larva is responsible for the destruction of "accitillo" *Zanthoxylum flavum* Vahl seeds.

***Exophthalmodes quindecimpunctatus* (Olivier)**

(The Corcho Prieto Weevil)

A very interesting weevil, recently found in Puerto Rico, but presumably present in the Island all the time. The insect was described by Mr. A. G. Olivier in 1807 and since then the species was not recorded again. The original description of the curculionid is in Latin and French; the following is a part of the French version:

"Les antennes sont d'un vert gris obscur. La trompe est courte, verte, avec une ligne élevée, noire. Le corcelet est d'un vert-doré, avec quatre

points noirs, placés sur une ligne transversale. L'écusson est vert. Les élytres sont d'un vert doré, avec sept pointes noirs sur chaque, dont l'un à l'angle de la base, at un impair sur la suture, vers l'extrémité: elles ont des stries de points, et sont terminées en pointe aigue. Le dessous du corps et les pattes sont vert-dorés. Les cuisses sont simples.

Il se trouve a Porto-Rico."

The weevil can be simply described as a 21-spotted iridescent green weevil. Presumably Olivier based his name on the approximate number of spots on the elytra, not taking in consideration the rest of the spots on the thoracic region.

This beetle can not be confused with any other in our insular fauna, because it is the only one of such color bearing spots on the elytra and thorax. Our common *Exophthalmodes roseipes* does not have the iridescence neither the spots on the body, this being the insect closest to it in general appearance. (See Plate VIII.)

Habits: The biology of the insect has not been studied yet. The adults feed on the foliage of its host tree and presumably the females lay their eggs on the foliage, following the same habit of our common "vaquita" *Diaprepes abbreviatus* (Linnaeus). This weevil has been only recorded from the southeastern corner of the Island.

Host: The weevils feed on the foliage of the "corcho prieto" tree, *Torrubia fragans* (Dum.-Cours.) Standley.

***Exophthalmodes roseipes* (Chevrolat)**

(La Vaquita Verde)

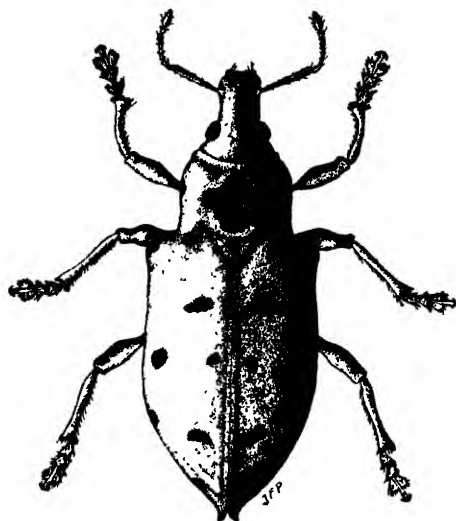
This abundant weevil commonly known as "la vaquita verde" or the green bug is considered as a pest of citrus in the northern coast of the Island, where it is most abundant. The insect also attacks many plants and trees, the adults feeding voraciously on the foliage. The weevil is only found on the north coast and there are no records of its presence in the interior or southern districts. The insect was originally described by Chevrolat, as follows:

"*Pachneus roseipes* sp. nov. D'un verte tendre, pattes et dessous du corps rosés. Trompe de la longueur de la tete et du prothorax, assez large, voutée en dessus, marquée d'une ligne noire. Yeux noirs, arrondis, saillants. Antennes longues, vertes, les trois derniers articles et la massue noirs. Prothorax couvert de petits points, poreux. Écusson arrondi, sillonné. Élytres offrant chacune quatorze stries punctuées, les quatre

PLATE VIII

Exophthalmodes quindecimpunctatus (Oliv.)

Diaprepes abbreviatus (Linnaeus)



(Luis F. Martorell: A Survey of the Forest Insects of Puerto Rico)

centrales réunies entre elles au de la du milieu. Long. 7.5 a 8.5 mill.; larg. 3 a 4 mill. (Chevrolat 1876 p. 227.)

The species was described originally under the generic name of *Pachneus*, later on, a generic transfer was made to the genus *Exophthalmodes*.

The adult has the same color of the tender leaves and is about one-fourth to three-eighths of an inch long. The legs and the ventral part of the body are of a rosy tinge.

Habits: The adult weevils are seen the whole year. The females lay their eggs between the leaves of host plants, usually in small groups of about six to twenty-four eggs. The larvae feed on the roots of plants, while the adults do the same on the foliage.

Natural Enemies: The giant toad, *Bufo marinus* (Linnaeus) is the principal enemy of the weevil.

Host: The adult weevil is polyphagous in its habits. It has been recorded from the following trees:

<i>Andira jamaicensis</i> (W. Wright) Urban	"moca"
<i>Chrysobalanus icaco</i> L.	"icaco"
<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"
<i>Conocarpus erectus</i> L.	"botoncillo"
<i>Dalbergia ecastophyllum</i> (L.) Taub.	"palo de pollo"
<i>Elaeodendrum xylocarpum</i> (Vent.) DC.	"coscorrón"
<i>Hymenaea courbaril</i> L.	"algarrobo"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Terminalia catappa</i> L.	"almendra"

***Diaprepes abbreviatus* (Linnaeus)**

(The Sugar Cane Root-weevil)

This is undoubtedly the most common weevil in the Island, a species which has been thoroughly studied by different investigators. (See IB, pages 294-7 for ref.) This insect is also recorded from Hispaniola and the Lesser Antilles.

Adults: The adults are variable in their markings and even in the general coloration of the elytra. Wolcott describes the adult as follows:

"The beetles are really black, but they are so thickly covered with minute or bright-coloured scales that their general appearance is far from sombre. These round or oval scales on the ridges of the back are often rubbed off, greatly changing the appearance of the beetles in forming a pattern of denuded black bands on a white or light-coloured background. The colours of the scales are almost as varied as those of the rainbow, descriptions of the various varieties mentioning white, bright yellow, empire yellow, ochreous, tawny-ochreous, yellow-green, greenish, golden-

green, blue-green, dark Hessian brown, light buff, buff-yellow, grey, salmon and alizarine crimson. The weevils vary as much in size as in colour, some being twice as long as others, three-eighths and three-fourths of an inch being the maximum and minimum length." (Wolecott, EEWI, p. 136-7.) (See Plate VIII.)



FIG. 14. Egg-clusters of *Diaprepes abbreviatus* (L.) between "jobo" leaves. Twice natural size. (Drawn by F. Seín.)

Egg: The eggs are very small, elongated in form and are laid in masses or clusters usually of more than 50 eggs. (See fig. 14.) The largest number of eggs counted in a mass have been 264. The eggs as described by Jones (1915), are as follows:

"The eggs are oblong-oval, smooth, glistening, with a rather tough

membranous covering, about 1.2 mm. in length and .4 mm. in diameter. Newly laid eggs are of a uniform milky white, but within a day or two after being laid, clear spaces appear at either end of the egg, this space being more pronounced at one end. Before hatching, the clear spaces disappear and the egg takes on a faint brownish tinge, the mouth-parts of the larva, contained within, being visible through the walls of the egg."

The egg hatches in about seven days, the young larva falls on the ground, digs in and feeds on the roots of plants. The life history of the larva has been very well studied by Wolcott (Oct. 1936) and from his work the following is cited:

"The females of *Diaprepes abbreviatus* (Linn.) lay 5,000 or more (or less) eggs in as few as two months, May and June, or in as many as seven months at other times of the year, often living over twice as long as do the males after emergence from the soil.

"The incubation period of all eggs is seven days. Larvae attain full size in two to four months. A diapause period is absolutely essential before pupation. The pupal period is about two weeks. Fully-formed adults remain within the pupal chamber for a variable period of weeks or months, the length of this period and that of the diapause period of the larva being subject to great variation.

"The great variation in the duration of the diapause period of the larva and before the emergence of the adult from the pupal cell in the ground permits some individuals to complete their life-cycle (hatching of eggs to first egg-cluster laid by the female, or emergence of male from soil) in less than eight months, but for other individuals it may extend for eighteen months (hatching of egg to last egg-cluster laid by female, or to death of male)." (Wolcott, Oct. 1936, p. 912.)

Natural Enemies: One of the favorite foods of birds is the adult beetle of this species. The following birds have been recorded as feeding on "vaquitas": Porto Rican petchary, *Tolmarchus taylori* (Selater) 18.47 %, (the percentage indicates the amount of "vaquitas" eaten as compared with the total bulk of the stomach contents) Gray kingbird, *Tyrannus dominicensis dominicensis* (Gmelin) 17.19%, flycatcher, *Myiarchus antillarum* (Bryant) 11.22%, "mozambique" or Porto Rican grackle, *Holotrichopus niger brachypterus* (Cassin) 9.69%, ani or "judío," *Crotophaga ani* (Linnaeus) 7.09%, owl or "múcaro", *Gymnasio nudipes* (Daudin) 1.8%, yellow shouldered blackbird or "mariquita", *Agelaius xanthomus* (Selater) 1.72%, (Wetmore 1916.) Danforth also names the owl, mangrove cuckoo, Porto Rican oriole and ani as predators of these weevils.

The common lizard, *Anolis cristatellus* Duméril & Bibron feeds on the adults in the field. So the giant toad, *Bufo marinus* Linn., which can consume a large amount of insect food.

Among the insect enemies of the "vaquita" the following could be mentioned: The larva of the neuropteroid *Chrysopa collaris* Schneider feeds on the eggs. The most important parasite is the tetrastichid wasp, *Tetrastichus haitiensis* Gahan a parasite of the egg (See fig. 15.) Not all the eggs of the weevil are parasitized as expected, due to the deviation from a one year life-cycle in which it enables its eggs to escape the attacks of the parasitic wasp, which is most abundant during the late Spring, but is very scarce during the Autumn and Winter. Two other parasites have been obtained from the eggs, but these presumably are secondary

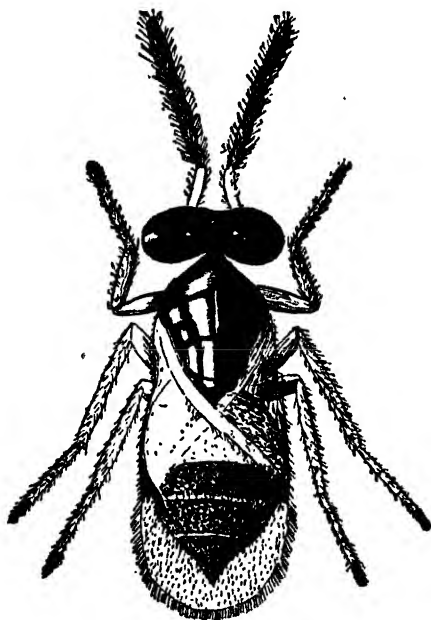


FIG. 15. *Tetrastichus haitiensis* Gahan. Sixty times natural size. (Drawn by G. N. Wolcott.)

parasites, attacking the larva of *Tetrastichus* rather than the weevil eggs. The more common one is an exceptionally large trichogrammid of a bright yellow color, *Ufens osborni* Dozier. The second is an entedontid black wasp, *Horismenus graciliventris* (Girault) (EEWI, p. 141).

Host: The weevils are polyphagous in their habits feeding on a long list of trees. The following have been recorded:

Acnistus arborescens (L.) Schlecht

"galán arbóreo"

Agati grandiflora (L.) Desv.

"gallito"

Albizia lebbek (L.) Benth.

"amor platónico"

<i>Anomis caryophyllata</i> (Jacq.) Krug & Urban	"malagueta"
<i>Andira jamaicensis</i> (W. Wright) Urban	"moca"
<i>Byrsonima spicata</i> (Cav.) DC.	"maricao"
<i>Cedrela mexicana</i> Roem.	"cedro"
<i>Cedrela odorata</i> L.	"cedro español"
<i>Ceiba pentandra</i> (L.) Gaertn.	"ceiba"
<i>Chrysobalanus icaco</i> L.	"icaco"
<i>Chrysophyllum cainito</i> L.	"caimito"
<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"
<i>Conocarpus erectus</i> L.	"botoncillo"
<i>Cordia alliodora</i> (R. & P.) Cham.	"capá prieto"
<i>Delonix regia</i> (Bojer) Raf.	"flamboyán"
<i>Erythrina berteroa</i> Urban	"machete"
<i>Erythrina poeppigiana</i> (Walp.) O. F. Cook	"bucare"
<i>Faramea occidentalis</i> (L.) A. Rich	"cafeillo"
<i>Ficus laevigata</i> Vahl	"jagüey"
<i>Ficus stahlia</i> Warb.	"jagüey"
<i>Gliricidia sepium</i> (Jacq.) Steud.	"madre de cacao"
<i>Guaiacum officinale</i> L.	"guayacán"
<i>Guarea trichilioides</i> L.	"guaraguao"
<i>Haematoxylon campechianum</i> L.	"campeche"
<i>Ilex syderoxyloides</i> (Sw.) Griseb.	"gongolf"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Lagerstroemia speciosa</i> (L.) Pers.	"reina de las flores"
<i>Leptoglottis portoricensis</i> (Urban) Britton & Rose	"zarzilla"
<i>Lonchocarpus domingensis</i> (Pers.) DC.	"genogeno"
<i>Longhocarpus latifolius</i> (Willd.) H. B. K.	"hediondo"
<i>Melicocca bijuga</i> L.	"quenepa"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Ocotea portoricensis</i> Mez.	"laurel"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Psidium guajava</i> L.	"guayaba"
<i>Spondias mombin</i> L.	"jobo"
<i>Swietenia macrophylla</i> King	"caoba de Honduras"
<i>Swietenia mahagoni</i> Jacq.	"caoba"
<i>Tamarindus indicus</i> L.	"tamarindo"
<i>Terminalia catappa</i> L.	"almendra"
<i>Torrubia fragans</i> (Dum.-Cours.) Standley	"corcho prieto"
<i>Triplaris caracasana</i> Cham.	"triplaria"
<i>Zanthoxylum caribaeum</i> Lam.	"espino rubial"

***Lachnopus coffeae* Marshall**

(The Coffee Weevil)

This weevil is considered as a minor pest of coffee. It is abundant during the months of April and May, when the adults feed on the foliage, blossom buds and berries.

From the original description the main characteristics are herewith cited:

"Male and female: Integument piceous, with the legs, antennae and apex of the rostrum reddish brown; clothed above and below with small, convex, shiny, suborbicular or very shortly ovate, white scales, which are mostly not contiguous, but more closely set here and there, leaving much of the integument exposed; the median area of the prothorax with very



FIG. 16. *Lachnopus coffeae* Marshall. Six, times natural size (Drawn: G. N. Wolcott.)

few scales, and on each side of it a more condensed but indefinite stripe, and a similar one just above the coxae, which continues across the mesosternum and broadens out on the metasternum; the elytra usually with three very irregular transverse subdenuded patches, sub-basal, median and postmedian, and sometimes a small one on the declivity." (Marshall 1922 p. 60.) Length 5.5 to 6.25 mm. Breadth 1.8 to 2 mm. (See fig. 16.)

Habits: Like the other weevils, this species lays its eggs between the leaves, in masses or clusters of fifty or more. The eggs are somewhat elongated with rounded ends, white or creamy in color, about one-thirtieth of an inch in length. The young larva emerges in twelve to fourteen days, drops to the soil, burrows in and feeds on the roots of plants. The life cycle takes about one year in this species. The adult weevils feed on the foliage of plants and trees, having a particular preference for coffee.

Natural Enemies: The eggs of the weevil are parasitized by the tetra-

stichid wasp, *Tetrastichus vaquitarum* Wolcott. This minute parasitic insect has a shining blue-black thorax, reddish eyes and yellowish head, antennae, abdomen and legs. Unfortunately it is not abundant in the fields. (Wolcott 1922, p. 18.)

Host: The weevils recorded from the foliage of "higüerillo", *Vitex divaricata* Sw.

***Lachnopus curvipes* (Fabricius)**

This weevil is similar in general appearance to the coffee weevil, but it has never been found feeding on coffee leaves and also is much larger in size, being about 9 mm. long. The species feeds on the foliage of different host trees, but never occurs in sufficient numbers to be considered a pest of economic importance.

Natural Enemies: There are many birds which feed on the adult beetles. Among them (Wetmore 1916) the following have been listed: Cuckoo, Ani, Owl, Kingbird, Porto Rican Petchary, Flycatcher, Mockingbird, Vireo, Parula Warbler, Honey Creeper, Yellow-shouldered blackbird, Oriole, Mozambique, Tanager, Spindalis, Grossbeak and Grasshopper Sparrow.

The common lizards *Anolis pulchellus* Duméril & Bibron and *Anolis cristatellus* Duméril & Bibron also feed on the adults.

The giant toad, *Bufo marinus* (Linnaeus) also helps in the control of the insect.

Host: The beetle feeds on the foliage of the following trees:

<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"
<i>Conocarpus erectus</i> L.	"botoncillo"
<i>Dalbergia ecastophyllum</i> (L.) Taub.	"palo de pollo"
<i>Guaiacum officinale</i> L.	"guayacán"
<i>Guaiacum sanctum</i> L.	"guayacán de vera"
<i>Inga vera</i> Willd.	"guaba"
<i>Isandrina emarginata</i> (L.) Britton & Rose	"vela muerto"
<i>Pisonia albida</i> (Heimmlerl.) Britton	"corcho"
<i>Varronia angustifolia</i> West.	"basora"

***Lachnopus seinei* Wolcott**

This insect is apparently not abundant in Puerto Rico. The only specimens collected came from the mountains north of Yauco and from Aibonito. The description of the species is as follows:

"Integument piceous to black, legs and antennae purplish-pink; entirely and evenly clothed with very small convex, shiny, subcircular scales with no constant areas of denudation. Length 6-8 mm." (IP, p. 302.)

Host: Collected on tender leaves of "mantequero", *Rapanea ferruginea* R. & P.) Mez.

Lachnopus yaucona Wolcott

Another species showing the same habits as the preceding, described as follows:

"Integument light brown to piceous, legs and antennae light yellow to reddish-brown; body and legs, except tarsi, evenly and densely clothed in light yellow, subcircular scales; punctures of elytra devoid of scales. Length 8 mm." (IB, p. 302.)

Host: On tender leaves of "mantequero", *Rapanea ferruginea* (R. & P.) Mez.

Apodrosus argentatus Wolcott

Another common weevil, particularly abundant in the lowlands and highly polyphagous in its habits. Also found in Mona Island. The chief characteristics of the species are the following:

"Integument piceous to black, legs dark reddish brown; except eyes, antennae, tarsi and puncture and striae of elytra, evenly and closely covered with small, subcircular, silvery scales, interspersed scantily on head, more thickly on prothorax with black scales.—Antennae yellowish brown, club darker.—Length 4 to 4.5 mm.; breadth 1.8 to 2 mm." (IP, p. 130.)

Host: The weevils feed on the foliage of the following trees:

<i>Colubrina arborescens</i> (Mill.) Sarg.	"abeyuelo"
<i>Dalbergia ecastophyllum</i> (L.) Taub.	"palo de pollo"
<i>Guaiacum officinale</i> L.	"guayacán"
<i>Guaiacum sanctum</i> L.	"guayacán de vera"
<i>Peirania polyphylla</i> (Jacq.) Britton & Rose	"retama"
<i>Tamarindus indicus</i> L.	"tamarindo"

Apodrosus wolcottii Marshall

A species related to the preceding but less abundant, found in the lowlands as well as at middle elevations. The main characteristics of this species are:

"Male and female: Integument black or dark piceous, fairly closely covered above with small, nearly circular, pinkish buff scales having a distinct coppery sheen; the elytra with sometimes and indefinite narrow band of dark brown scales behind the middle between striae 3 and 6; the lower surface with coppery grey scaling along the sides of the sternum and venter, the median area with sparse short curved pale squamiform setae.—Antennae testaceous brown, long and slender, the distal joints of the funicle much longer than broad.—Legs piceous, with rather sparse scales and spatulate setae; the femora unarmed.—Length 3.5 to 5 mm.; breadth, 1.6 to 2.4 mm." (Marshall 1922, p. 59.)

Natural Enemies: The weevils have been eaten by the lizard, *Anolis krugii* Peters. (IB, p. 303.)

Host: Abundant, feeding on the foliage of "guaba", *Inga vera* Willd.

***Peridinetus concentricus* (Olivier)**

(The Higuillo Weevil)

A very interesting and conspicuous weevil with white and black markings, found in the lowlands and mountains of the Island. The species is also reported from Sto. Domingo, from which it was originally described by Olivier, as follows:

"Il est ovale. Les antennes sont noires. La trompe est noire, courbée, cylindrique, marquée vers sa base d'une ligne peu élevée. Le corcelet est d'une couleur cendrée ferrugineuse, avec une grande tache très-noire. Les élytres sont striées, noires, avec une tache ferrugineuse à la base extérieure, une autre irrégulière à l'extrémité, quelques points irréguliers et une grande tache presque annulaire, commune, vers le milieu. Les pattes sont noires, avec un anneau ferrugineux sur les cuisses. Toutes les cuisses sont dentées. Il se trouve à Saint-Domingue." (Olivier 1807, p. 207.)

In Olivier's original description the insect is described as ferrugineous and black, presumably he based his description on old specimens, which undoubtedly were somewhat discolored. Fresh specimens observed in the field show distinctly black and white markings. The insect is very easy to recognize because it is our only fairly large weevil with black and white markings. (See illustration in IB, p. 306.)

Habits: The adults feed on the foliage of plants, doing small circular holes in the leaves while feeding. The larva has been recorded as boring in the stems of the host plants.

Host: The following trees are attacked by the weevil:

Piper aduncum L. "higuillo"

Piper amalago L. "higuillo de limón"

***Lechriops psidii* Marshall**

A common weevil found at lower and middle elevations in Puerto Rico, considered as a pest of guava fruits. The following are notes about its original description.

"Male and female: Integument red-brown; the head with a dense edging of pale buff scales between and behind the eyes; the prothorax clothed with rather sparse narrow brownish-yellow scales, mostly transverse in position and leaving much of the integument exposed, . . . the elytra fairly densely covered with mingled pale buff and whitish scales, and with an ill-defined curved dark transverse band about the middle between

striae 1 and 8, which is deepest on interval three and rapidly narrows outwards to a point on interval eight; . . . the mesosternum, metasternum and abdomen uniformly covered with large subcontiguous white scales.

Antennae with joint 2 of the funicle longer than 1, as long as 3-5 together.—Legs testaceous, the femora with dense white scaling, the tibiae with thinner hair-like scales.—Length 2 mm.; breadth 0.9 mm.” (Marshall 1922, p. 69-70, with illustration on Plate I, fig. 4.)

Habits: The maggots or larvae of this weevil infest the fruits of guava trees, destroying a large percentage of them. Most of the attacked fruits turn black when about half grown, later becoming hard and mummified as the maggots of the beetle develop within them. (EEWI, p. 519.)

Host: The weevil which is apparently limited in distribution to the island of Puerto Rico, has been only recorded attacking “guayaba”, *Psidium guajava* L. fruits.

Sitophilus linearis (Herbst)

(The Tamarind Weevil)

An interesting species of weevil described from the West Indies by Herbst in 1797, probably a native of India, introduced in tamarind seeds into the West Indies. The insect is also found in the Atlantic States. The species is similar to *S. oryza* (Linnaeus) but is distinguished from it by its more convex thorax with fine even punctures, distinctly separated. *S. linearis* is also a larger insect; it can be described as follows:

“Elongate-oblong. Color variable, usually piceous or brown, the head black. Beak usually black, its tip red, twice as long as head, straight, cylindrical, finely striate-punctate. Thorax nearly twice as long as wide, convex, strongly narrowed in front and constricted behind the apex; . . . Elytra subdepressed, scarcely longer and not wider at base than thorax, striae closely punctate; alternate intervals slightly wider. Under surface finely and closely punctate. Length 3.3 to 3.8 mm.” (Blatchley & Leng 1916, p. 574-5.)

Host: The larvae of the weevil feed in the tamarind seeds, *Tamarindus indicus* L.

Sitophilus oryza (Linnaeus)

(The Rice Weevil)

This cosmopolitan insect pest of stored grains is very abundant in the Island. The insect has more or less the same appearance of *S. linearis* (Herbst), but the punctures of the thorax are rather coarse, deep, very dense, especially toward the sides, rounded, not elongate and the surface

rather depressed on the disc. It is a small species of about 2.1 to 2.8 mm. in length. (Description in Blatchley & Leng 1916, p. 575.)

Natural Enemies: The weevil is eaten by birds. Wetmore 1916, lists the Latimer's vireo as feeding on the weevil. It is also parasitized by pteromalid wasps, *Aplastomorpha calandrae* (Howard).

Host: The weevil has been collected on the foliage of casuarinas, *Casuarina equisetifolia* Forst., and also reared from "mamey" seed, *Mammea americana* L.

FAMILY PLATYPODIDÆ

The Family Platypodidae and its related Family the Scolytidae is discussed by certain authors as different families under one single group known as the Superfamily Scolytoidea. Others include the Platypodidae as a subfamily under the Family Scolytidae and divide it as follows: (1) Platypodinae (2) Scolytinae and (3) Ipinæ.

For the purpose of this discussion the two families will be treated separately.

The members of the Family Platypodidae are very few in number in our insular fauna, as compared with the large number of species in other parts of the American continent.

The biology of our forms has not yet been studied. Investigators in all parts of the world, especially those of the temperate regions of the globe have done extensive investigations in these two groups of insects. Chamberlin (1939) recently published a complete study on the North American species, containing valuable information on the biology and taxonomy of the Scolytoidea.

The two families can be separated by means of the following key:

Tarsi with the first segment as long as the others united; head prominent and as broad as the thorax . . . PLATYPODIDÆ

Tarsi with first segment much shorter than the others united; head invisible from above or much narrower than the thorax . SCOLYTIDÆ.

The following species in the Family Platypodidæ are the ones affecting our trees:

Platypus excisus Chapuis

A species recorded from "guaba", *Inga vera* Willd., at middle elevations.

Platypus ratzenburgi Chapuis

A fairly common species in Puerto Rico, also found in Mexico, Central America and Texas. The insect has been collected at lights at the Guánica

Insular Forest, at lower elevations and also in flowers at Aibonito, at middle altitudes. The following is the description of the species:

"Male front entirely opaque, finely rugose; prothorax feebly punctulate. Elytra finely, not deeply striate, transversely impressed at tip, without subapical processes. Ventral segments shining, sparsely and finely punctured.

Female front areolate, prothorax unequally punctulate and punctured, less finely at the sides. Elytra deeply striate-punctulate, interspaces more convex behind; second elevation forming a small cusp at the posterior declivity. Posterior processes with three teeth of nearly equal length, the outer one broad and not very distinctly separated from the upper one, the inferior one a little shorter and acute. Prothorax but little longer than wide. There is no transverse impression at the anterior apex of the impressed dorsal line." (Chamberlin, p. 110.)

Host: Recorded from the following trees:

<i>Andira jamaicensis</i> (W. Wright)	Urban	"moca"
<i>Dacryodes excelsa</i> Vahl		"tabonuco"

***Platypus compositus* (Say)**

This is a very common species of beetle in continental United States with a wide variety of host trees. In Puerto Rico, it has only been recorded once at middle elevations, boring in the trunk of a tree. The species is described as follows:

"Antennae, terminal segment dilated, compressed, oval, nearly as large as the eye; elytral striae with subquadrate punctures, approximate, slightly indented; tip of each elytron with two small longitudinal teeth and an elongated process which is tridentate, intermediate teeth emarginate. Male apical part of front smooth, prothorax scarcely punctulate; elytra transversely impressed near the tip, without posterior process. Ventral segments shining, sparsely punctulate. Female prothorax distinctly punctulate; elytra with the second interspace compressed and forming an acute cusp near the tip. Fifth and ninth interspace prolonged into a large process, which is concave above and tridentate at the tip. The outer tooth much longer, narrow and truncate or emarginate at tip according to age of specimen. Fifth ventral segment flat, not carinate nor tuberculate." (Chamberlin, p. 110-11.)

Host: From "tabonuco", *Dacryodes excelsa* Vahl, logs.

Family Scolytidae

***Stephanoderes brazilensis* Hopkins**

A species recorded from "almendra" fruits, *Terminalia catappa* L., from dry guava fruits, *Psidium guajava* L., and from branches of "flamboyán", *Delonix regia* (Bojer) Raf.

Stephanoderes brunneus Hopkins

This species was originally described from Texas as follows:

"Length female type, 1.35 mm., body stout, dark brown, shining; pronotum with rugose space red, anterior margin with two widely-separated teeth." (Chamberlin, p. 309.)

Host: Recorded from mangrove seed balls, *Rhizophora mangle* L.

Stephanoderes buscki Hopkins

This species has been recorded from the pods or fruits of the following trees:

<i>Hymenaea courbaril</i> L.	"algarrobo"
<i>Psidium guajava</i> L.	"guayaba"
<i>Tamarindus indicus</i> L.	"tamarindo"

Stephanoderes georgiae Hopkins

A species which is not abundant in the Island, also recorded from Georgia, U. S. A., from which the original specimens were described as follows:

"Length female type, 1.5 mm.; uniform dark reddish brown; pronotal margin with six marginal teeth; front convex, with median line and minute posterior elevations; elytral striae distinctly impressed, punctures coarse." (Chamberlin, p. 303.)

Host: From guava fruits, *Psidium guajava* L.

Stephanoderes trinitatis Hopkins

A species reared from branches of "guaraguao", *Guarea trichilioides* L.

Hypothenemus parvus Hopkins

Reared from the pods of "maga", *Montezuma speciosissima* Sessé & Moc.

Hypothenemus eruditus Westwood

This species has been collected at Doña Juana Camp, altitude 1,900 ft. The insect is described as follows:

"Body elongate. Elytra black, pronotum dark to light but uniform reddish. Antennal club compressed throughout. Pronotum with apical margin broadly rounded and armed with several small marginal teeth. Elytral striae and stria punctures distinct, intervals with scales. Length of female scarcely 1 mm." (Blatchley & Leng 1916, p. 595.)

Host: From a dead pole that appeared to be "maricao", *Byrsonima spicata* (Cav.) Rich.

Ambrosiodmus lecontei Hopkins

A species recently recorded from the Island, also found in Florida.

Description: "Length, female type, 2.85 mm.; body elliptical, dark-reddish brown; pronotum lighter, broader than long, posterior dorsal area subopaque, lateral area shining, becoming smoother and punctured toward posterior angle; front subopaque, rugosely punctured and with median shining line; elytral striae with coarse and rather deep punctures, interspaces narrow and irregularly punctured, declivity convex, faintly impressed to middle, interspace 2 armed with two acute denticles, 3 to 6 granulate, apex obtusely rounded, posterior and lateral margins faintly elevated, smooth." (Chamberlin, p. 440.)

Host: The insect was reared from the wood of the following trees:

<i>Cedrela mexicana</i> Roem.	"cedro"
<i>Dacryodes excelsa</i> Vahl	"tabonuco"

Xyleborus affinis Eichhoff

A very common species in the Island, perhaps our most common member of the entire family. It is also found along the Atlantic States, Gulf States and Mexico.

Description: "The female is light reddish-brown, about 2.5 mm. long; the pronotum longer than wide, with the posterior area smooth, shining, sparsely and finely punctured; elytral striae weakly punctured in faintly regular rows, declivity oblique subopaque, first and third interspaces armed, second unarmed, flat or faintly impressed.

The male is smaller, 2.25 mm. long, lighter in color, with the anterior area of pronotum excavated and the apex produced; striae punctures somewhat confused." (Chamberlin, p. 452.)

Host: The beetle has been reared from the trunk of trees, which were nearly dying or in a very weak condition:

<i>Albizia lebeck</i> (L.) Benth.	"acacia amarilla"
<i>Cocos nucifera</i> L.	"coco"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"

Xyleborus confusus Eichhoff

Another common species of *Xyleborus* found in the Island, also recorded from Chile, Venezuela and the United States (Mississippi).

Description: "The females are reddish-brown in color; about 2.5 mm. long, 2.7 times as long as wide. The front of the head is broad, subopaque, reticulate, moderately punctured, with a distinct elevated median line extending from the epistomal margin to above the level of the eyes. The pronotum is subquadrate, very broadly rounded in front, shining behind,

minutely and sparsely punctured. The elytra are narrower than the pronotum, brightly shining, with the striae very shallowly punctured on the disc, the declivity of the same type as *fuscatus*." (Chamberlin, p. 454.)

Host: Collected from the following trees:

<i>Andira jamaicensis</i> (W. Wright)	Urban	"moca"
<i>Cocos nucifera</i> L.		"coco"
<i>Erythrina glauca</i> Willd.		"bucare"

Xyleborus inermis Eichhoff

A rare species in Puerto Rico, also recorded from New Jersey to West Virginia and Tennessee.

Description: "Elongate, cylindrical. Ferruginous-testaceous, shining sparsely pubescent. Thorax oblong, disc subimpressed on each side, punctate behind. Elytra faintly uniseriately punctulate with broad interspaces; apex declivous, depressed, flat, almost smooth, opaque, feebly armed, faintly impressed at suture. Length 2.4 to 2.6 mm. (Eichhoff.) Male 1.8 mm. long, oblong-elliptical, light yellowish brown. Pronotum with sides parallel, anterior area broadly impressed, with anterior margin scarcely produced with obtuse subapical tubercules, rugosities fine, extending to median broad elevation, posterior and lateral area shining, faintly punctured. Front convex, subopaque, with anterior median shining space. Elytra with sides parallel to vertex, basal and lateral areas shining, feebly punctured, declivity oblique, opaque, subconvex, striae with faintly shining discs, interspaces 1, 3 and 4 with a few granules, pubescence moderately long; head moderately large." (Hopkins.) (Chamberlin, p. 451.)

Host: From "mango", *Mangifera indica* L.

Xyleborus sacchari Hopkins

A very common species in the Island, particularly found in the sugar cane fields where all stages can be collected from rotten or dry canes. It also attacks trees, and so far it has been recorded from "guaba", *Inga vera* Willd. and "guayaba", *Psidium guajava* L.

Xyleborus fuscatus Eichhoff

Another species recently recorded from the Island described as follows:

"The female is reddish-brown in color, 2.6 to 3.2 mm. long; 2.9 times as long as wide. The front of the head is reticulate, subopaque, coarsely punctured with a short shining median longitudinal elevation; the pronotum is 1.18 times as long as wide with the sides sub-parallel, broadly rounded in front, the posterior area shining, rather finely punctured.

The elytra are shining, the striae weakly impressed, coarsely and closely punctured; the interspaces sparsely punctured; declivity sloping, first interspace with one small tooth at apex, otherwise unarmed, second flat, unarmed, third with several granules at summit, and with one large tooth midway of the descent." (Chamberlin, p. 453.)

Host: Collected in logs of "almácigo" *Bursera simarouba* (L.) Sarg.

Xyleborus grenadensis Hopkins

A recently recorded species collected in logs of "almácigo", *Bursera simarouba* (L.) Sarg.

DIPTERA

Very few species in this Order are injurious to trees, with the exception of several members of certain families like the Tephritidae and Itonididae, formerly known as Trypetidae and Cecidomyiidae respectively. Some families in this group include parasitic and predaceous forms, like those belonging to the families Larvaevoridae and Syrphidae, the former previously known as Tachinidae. The members of these two families play a very important role in the natural control of tree pests. As already stated in the Introduction of this work, the parasitic forms will not be included in this discussion.

FAMILY ITONIDIDÆ

Itonida coccolobae (Cook)

This insect produces galls in the foliage of trees belonging to the genus *Coccolobis*. It was originally described by M. T. Cook, as *Cecidomyia coccolobae* from specimens collected in Cuba. The original description is as follows:

"*Cecidomyia coccolobae* Cook, is a small gall about 2 to 5 mm. in diameter and projecting on both surfaces of the leaf of *Coccoloba wifera* Linn. Described from galls on a single dried leaf." (Cook, p. 145.)

No studies have been made on the biology of this species and the fly itself never has been described.

Host: The following host trees have been recorded for this species:

Coccolobis wifera (L.) Jacq.

"uva de playa"

Coccolobis pirifolia Desf.

Ctenodactylomyia watsoni Felt

This species is another gall forming insect also affecting trees of the genus *Coccolobis*. The insect has been thoroughly discussed by Felt in a previous publication. Presumably the type of gall caused by this species

is different from the one already discussed above. The following is a description of the fly:

Female: "Length, 3 mm. Eyes confluent. Antennae nearly as long as the body, sparsely haired, light brown; 14 segments, the third and fourth fused, the fifth with a stem about one-fifth the length of the subcylindric basal enlargement, which latter has a length three and one-half times its diameter and sparse sub-basal and subapical whorls of moderately stout setae; circumfili near the basal third and apically; terminal segment produced, apically with a finger-like process about one-third the length of the cylindric basal enlargement, which later has a length three times its diameter. Palpi; first segment with a length over twice its diameter, the second as long as the first, somewhat stouter, the third more than twice the length of the second, slender; mouth parts slightly produced, with a length about one-fourth the diameter of the head. Mesonotum dark-reddish brown, the submedian lines and median area a slaty gray. Scutellum pale orange apically, grayish basally; postscutellum dark brown. Abdomen dark brown, sparsely short haired. Wings very narrow, with a length fully three times the width; subcosta uniting with the costa at the basal third, the cross vein indistinct, the third vein joining the posterior margin well beyond the apex of the wing, the fifth vein forked, the rudimentary anterior branch uniting with the margin near the distal third, the well-developed posterior branch at the basal third. Halteres yellowish white, the club slightly fuscous. Coxae dark brown, reddish brown apically, the anterior femora and tibiae mostly dark brown, the former yellowish white basally, the latter narrowly annulate with white basally; tarsi a dark grayish brown, the distal three segments mostly yellowish gray, the posterior femora with the basal half yellowish white, and the entire tarsi mostly yellowish gray, otherwise as in the anterior tarsi; claws moderately long, stout, distinctly angulate basally, with three relatively large and two minor pectin; pulvilli rudimentary. Ovipositor short, the lobes roundly rectangular and thickly setose, minor lobe tapering to a narrowly rounded apex.

Male: Length, 3 mm. Antennae probably extending to the second abdominal segment, the fifth with a stem about one-fourth the length of the cylindric basal enlargement, which latter has a length thrice its diameter and rather thick subbasal and subapical whorls of stout, nearly straight setae; terminal segment with a finger-like appendage nearly one-half the length of the cylindric basal enlargement, which latter has a length thrice its diameter; claws slender, slightly curved and with about five well-developed and two minor pectin. The claws are more slender and the pectin more numerous than in the female. Genitalia; basal clasp segment long, stout; terminal clasp segment as long as the basal, rather

stout, somewhat irregular and with a well-developed though inconspicuous tooth apically; dorsal plate short, deeply and roundly emarginate, the lobes well separated and tapering to a narrowly rounded, thickly and coarsely setose apex; ventral plate long, broad, broadly and slightly emarginate, the lateral angles rather thickly and coarsely setose; style rather long, stout, narrowly rounded. Other characters as in the female.

Gall: Diameter, 3 mm. circular, blisterlike, dark green, with a slight, darker, median nipple. The gall shows equally upon both sides of the leaf.

Larva: Length 3 mm., yellowish, the segmentation distinct and tapering toward the posterior extremity. Head and breastbone indistinct in the one specimen before us.

Exuviae: Length 3 mm., whitish transparent. Antennal cases extending nearly to the base of the abdomen, wing pads to the third abdominal segment, and the leg cases about to the sixth abdominal segment; cephalic horns large, chitinous approximate, the lateral margins strongly serrate and tapering irregularly to the median line, the abdominal segments each with a transverse row of about 8 chitinous spines near the anterior third, the number being reduced to about 4 on the penultimate segment; terminal segment bilobed.

Pupa: Length 3 mm., moderately stout and variably yellowish or dark brown, dependent upon the development, the external structures as in the exuviae." (Felt 1915, p. 200-1.)

Host: Producing the galls on the foliage of "uva de playa" or sea-grape, *Coccolobis uvifera* (L.) Jacq.

FAMILY TEPHRITIDÆ

Anastrepha mombinpraeoptans Seín

This species of fruit fly and its related form *A. unipuncta* Seín are fully discussed by Mr. F. Seín Jr., in a work published in the Journal of the De-

PLATE IX

FIG. 1. *Anastrepha mombinpraeoptans* Seín, right wing greatly magnified.

FIG. 2. *A. unipuncta* Seín, right wing greatly magnified.

FIG. 3. *A. fraterculus* Wied. right wing of this Argentina species, to show differences with *A. mombinpraeoptans* Seín.

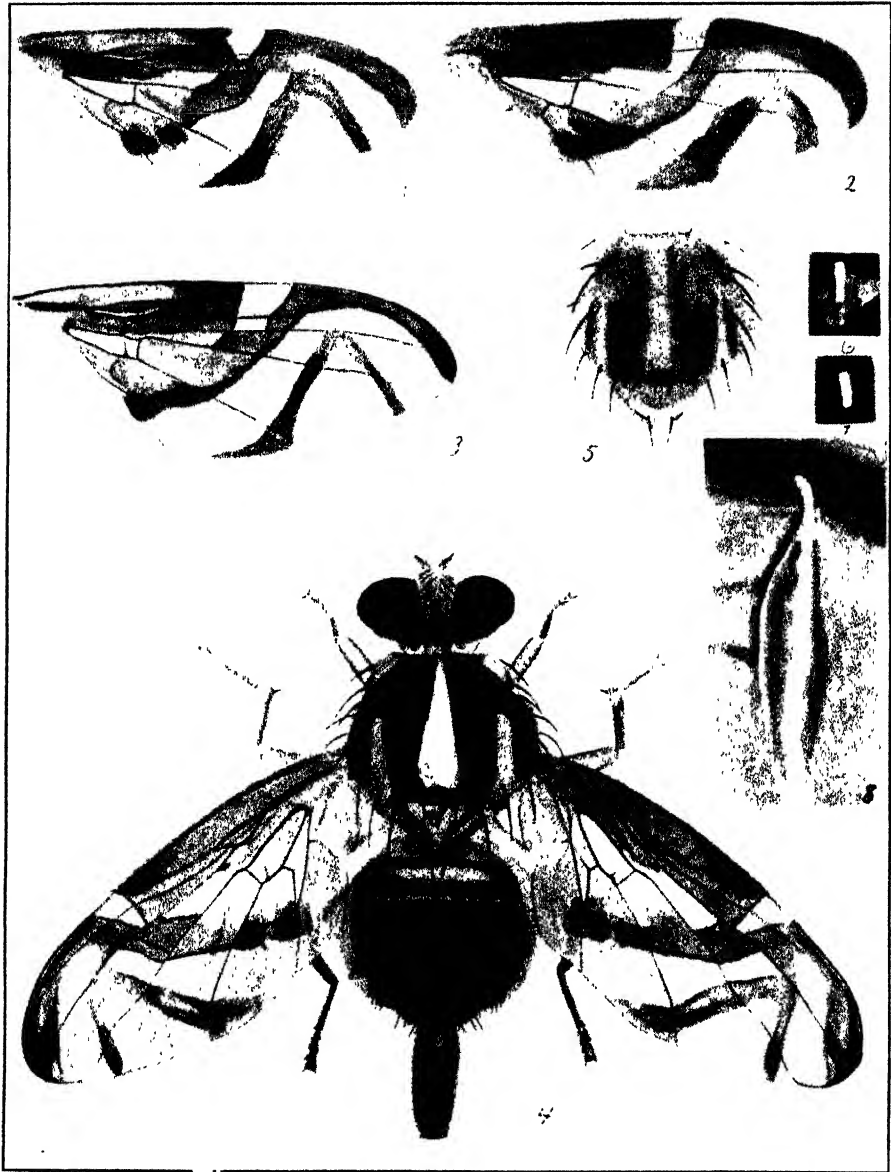
FIG. 4. *A. mombinpraeoptans* Seín, dorsal view of female adult, greatly magnified.

FIG. 5. *A. unipuncta* Seín, dorsal view of thorax.

FIG. 6. End of the egg of *A. mombinpraeoptans* Seín protruding out of the cuticle of a green fruit, greatly magnified.

FIG. 7. Same, the end of the egg protruding out of a ripe fruit.

FIG. 8. Shows insertion of the egg in a fruit of *Spondias mombin* L. greatly magnified. (Drawn by F. Seín Jr.)



(Luis F. Martorell. A Survey of the Forest Insects of Puerto Rico)

partment of Agriculture of Puerto Rico, volume 17, pages 183-196, 1933, in which the two species are described and illustrated by means of numerous plates.

While the two flies are almost impossible to be differentiated in their larval stages, yet the eggs and adults present enough differences to separate both species.

Habits: The fly lays the eggs in the fruit of the host tree. The egg is inserted in the fruit up to the shoulder, the head and neck protruding outside the cuticle. (See figs. 6 and 8 on Plate IX.) In this respect it differs from the egg of *A. unipuncta* Señ, in which the egg has no neck and is deposited entirely underneath the cuticle of the fruit. The larva on emerging bores inside the fruit and feeds on the tissue inside. After feeding for some time and when ready to pupate, the fully grown larva pierces the skin of the fruit, drops to the soil and pupates there. Few days later the adult fly emerges, and so the cycle is continued.

Natural Control: The fly is controlled in the field by a group of natural parasites, the most important of them being the braconid wasp, *Opius anastrephae* Viereck. Parasitism as high as 49.9% has been recorded with this species. The figitid wasps, *Canaspis hookeri* Crawford and *Eucoila atriceps* Kieffer have been also listed as parasites of this pest. Another braconid, *Microbracon* sp. has been reared from the larva.

Host: In Puerto Rico this species has been recorded from the fruits of the following trees:

<i>Anacardium occidentale</i> L.	"pajuil"
<i>Eugenia jambos</i> L.	"pomarroza"
<i>Eugenia malaccensis</i> L.	"manzana malaya"
<i>Mangifera indica</i> L.	"mangó"
<i>Psidium guajava</i> L.	"guayaba"
<i>Spondias cirouella</i> Tussac	"ciruela"
<i>Spondias dulcis</i> Forst.	"cítara"
<i>Spondias mombin</i> L.	"jobo"
<i>Spondias purpurea</i> L.	"jobillo"

Anastrepha unipuncta Señ

The adult of this fly can be readily differentiated from *A. mombinpraeoptans* Señ by a dark spot on the suture between the metathorax and the scutellum. Also as stated before, the egg has no neck and is inserted entirely underneath the cuticle of the fruit. The larva has the hairs or rays in the posterior spiracles more numerous, closer together and somewhat less branched. No character has yet been found to distinguish the puparium. An occasional puparium may be formed inside the fruits in

which the larvae have developed, a habit which has not been observed in *A. mombinpracoptans* Señ (Señ 1933, p. 190.)

Habits: More or less the same habits as the preceding species.

Natural Enemies: The insect is parasitized by the figitid wasp, *Eucoila atriceps* Kieffer and also by the introduced parasitic spalangid, *Spalangia philippensis* Fullaway.

Host: The fruits of the following trees are attacked by this fly:

<i>Annona reticulata</i> L.	"corazón"
<i>Chrysobalanus icaco</i> L.	"icaco"
<i>Chrysophyllum cainito</i> L.	"caimito"
<i>Eugenia jambos</i> L.	"pomarrosa"
<i>Psidium guajava</i> L.	"guayaba"
<i>Sapota achras</i> Mill.	"zapodilla"
<i>Spondias dulcis</i> Forst.	"cítara"
<i>Terminalia catappa</i> L.	"almendra"

LEPIDOPTERA

SUPERFAMILY PAPILIONOIDEA

FAMILY PAPILIONIDÆ

Papilio pelaus (Fabricius)

(The Espino Rubial Swallowtail)

This large papilionid is fairly abundant in the island of Puerto Rico. It has been also recorded from Cuba, Jamaica and Hispaniola.

Butterfly: In general the upper surface of wings is of a black color, with a creamy white band running almost in a straight line from the inner angle of the fore wing to the middle of the costa, and with similarly colored marginal lunules on the hind wing, where there are also several brick-red submarginal spots, extending upward from the anal angle. The tail is well developed, black. The under surface is similar to the upper, except that the submarginal red spots of the hind wing form a complete row, each spot edged with white. Length of f.w., 48 mm. (Bates, p. 113.)

Caterpillar: The fully grown caterpillars are about 45 mm. long and 10 mm. broad at the thorax; head dull light yellow, very dark brown around the ocelli, numerous spots subtending hairs and the inverted Y creamy; general color of body purplish and greenish brown (olive-drab), intricately marked with darker brown anteriorly, especially partly surrounding two dull yellow areas just posterior to the orange-yellow osmateria, and posteriorly with numerous lighter markings like wisps of white smoke; large, very irregular creamy spots on the sides of 5th, 6th, and 7th,

(together) and 10th, and 11th, segments, with narrow whitish band, connecting them just above the legs; two latero-dorsal warts on each segment, usually lighter colored and with a small lavender spot, irregular but sharply outlined, mediad of each wart, similar lavender spots occurring along the sides and below the spiracles, additional smaller lateral warts on the thorax; true legs dull light yellow, tipped and laterally marked with brown. (IP, p. 147-8.)

Host: The caterpillar feeds on the foliage of "espinio rubial", *Zanthoxylum martinicense* (Lam.) DC. Observed at altitudes ranging from sea-level to 1,000 ft.

FAMILY PIERIDÆ

Ascia monuste (Linnaeus)

This butterfly is very abundant in Puerto Rico. It is a typical lowland insect mostly seen around the coast and coastal hills, especially in the dry southern and south-western districts of the Island, but often observed at middle altitudes up to 2,000 ft. The insect has a wide geographical distribution over the American tropics and the West Indies. (Recorded by Möschler, p. 97 and in IB, p. 403 as: *Picris monuste* Linnaeus.)

Butterfly: The butterfly is variable in color, thus it is very difficult to give an accurate color description of the insect. Usually it is whitish in both wing surfaces. On the upper surface the fore wings are bordered with black on the outer margin, projecting inward on the veins. The female is of a darker color and the borders of the wings still darker than in the male. (See illustration of butterfly on Plate X.)

Eggs: The eggs are spindle-shaped, with vertical, raised ridges, and of a bright yellow color.

Caterpillar: The fully grown caterpillar is 35 to 40 mm. long, body gray, covered with numerous black spots, dull; dorsally three bright yellow lines run parallel to the body from the head to the last anal segment; setae on the area between the yellow lines, black, all originating in small, but conspicuous tubercules. Laterally on both sides of the body a bright yellow line runs parallel to the dorsal lines. Ventral to this line all setae are white, abundant. Head gray, with numerous black and white setae, the black ones originating in small black tubercules; labrum and antennae white; epicranial region near the first body segment on the dorsal part, and part near mouth yellowish. Spiracles small, oval, shiny, black. Ventrally of a greenish gray, with green legs.

Habits: As soon as the caterpillar emerges from the egg starts feeding on the tender foliage. After two or three days of feeding in such a way,

it moves to older foliage, feeding upon it voraciously. In about 20 days they are fully grown and ready to pupate. Pupation period is about 7 days.

Host: The caterpillar feeds on the foliage of "burro", *Capparis coccolobifolia* Mart. and "burro blanco", *Capparis portoricensis* Urban.

Phoebis agarithe (Boisduval)

This butterfly has a wide range in distribution, from the southern United States, to Central South America and the West Indies. In Puerto Rico it is rather scarce, usually found at lower elevations.

Butterfly: The male is uniform bright orange above, somewhat lighter below, with various fine reddish brown markings. The female is sometimes quite similar to the male, often lighter colored with heavier markings. The sub-median spots of the fore wing on the under side form a straight line in both sexes. Length of f.w., 32-35 mm. (Bates, p. 135-6.)

Host: Mr. Cesáreo Pérez of Río Piedras, has reared the caterpillar from "guamá americano", *Pithecellobium dulce* (Roxb.) Benth.

Phoebis argante (Fabricius)

This butterfly occurs in Florida, Texas, Central and South America, (Surinam, Colombia, Brazil) Cuba and Hispaniola. Rather scarce in the Island, recorded only once, at Cayey (presumably around 1,000 ft. altitude).

Butterfly: The male is similar to the male of *P. agarithe* (Boisduval); it is most easily distinguished by the interrupted course of the postmedian spots, on the fore wing. In *agarithe*, the reddish bar on the under side of the fore wing, which extends from about vein Cu_2 to R_1 is entire, straight. In *argante*, this bar is interrupted in the middle, becoming a somewhat zig-zag series of spots. These characteristics apply only to the male of both species. The female is rather variable, often very heavily marked. Length of f.w., 32-35 mm. (Bates, p. 135.)

Host: The caterpillar feeds on the foliage of *Inga vera* Willd., our common "guaba".

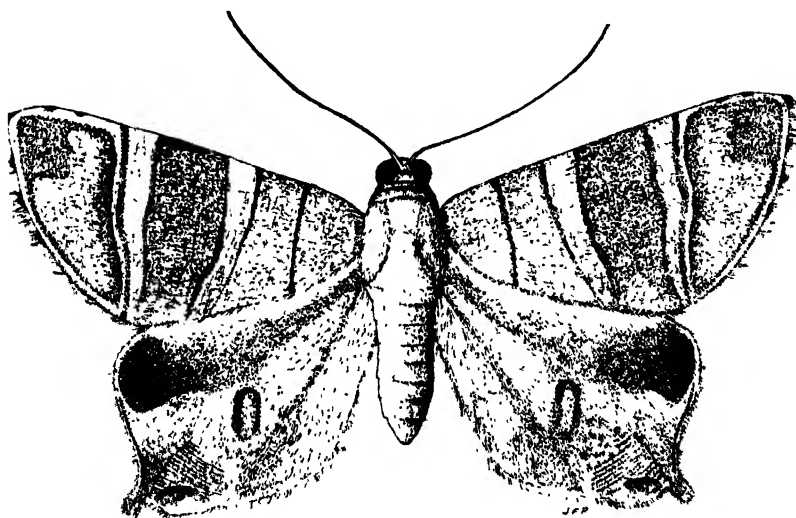
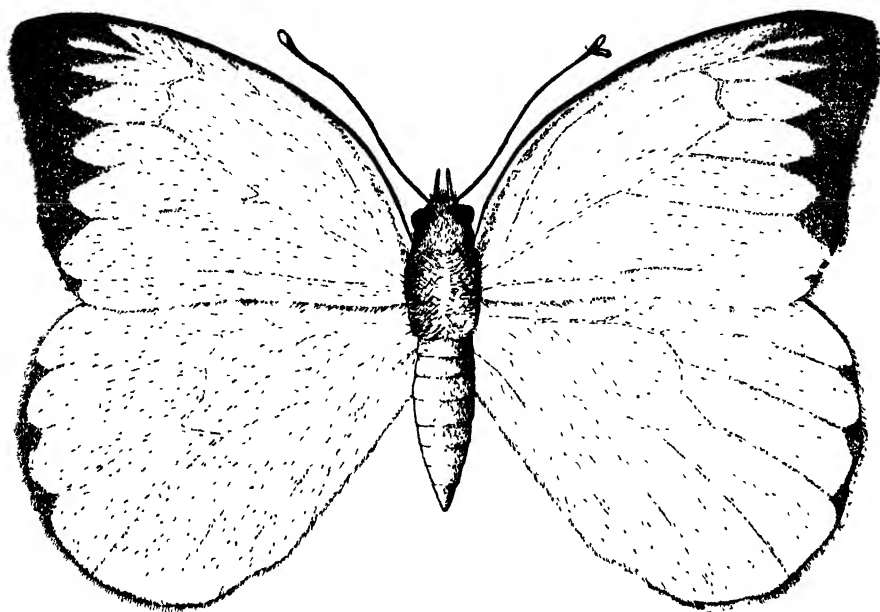
Phoebis statira neleis (Boisduval)

(The Quenepa Sulphur)

This butterfly although rather scarce in Puerto Rico, apparently is a rather common species in other parts of the American tropics. Also

PLATE X

Ascia monuste (Linnaeus)
Eulepidotis addens (Walker)



recorded from Florida, the West Indies, Central and South America. (Listed in IB, p. 404 as: *Aphrissa statira* Cramer.)

Butterfly: From specimens observed at the U. S. National Museum the following general description of both sexes is given:

The male with half of the wings nearest to the base, of a yellowish green color, outer half light yellow to white. The female whitish or yellow with brown markings, very conspicuous on outer margin of fore wing and a brown spot at the end of the discal cell. Length of f.w. 25-30 mm.

Host: The caterpillar of this species feeds on the leaves of "quenepa", *Melicocca bijuga* L. The host tree is planted in the lowlands, and is especially abundant in the southern, dry districts of Puerto Rico. Apparently the butterfly is most abundant during the summer and fall months, from July to September.

Kricogonia castalia (Fabricius)

(The Guayacán Butterfly)

Due to the great scarcity of its host tree in Puerto Rico, this species is very scarce. Dr. Gundlach recorded this insect many years ago and he observed that it was common near the coasts. The butterfly is abundant in Haiti, Cuba, Jamaica, Mexico, Florida, Texas, Venezuela and presumably in Central America. Mr. Cesáreo Pérez, collected three specimens at Salinas. Dr. G. N. Wolcott (1927) published an interesting article about the abundance of these butterflies in Haiti, in which he also gives a description of the caterpillars and chrysalis.

Butterfly: The ground color varies from white to greenish yellow; the base of the wings has only traces of yellow, and the undersurface, especially of the fore wing, is even less yellow. There is a great variation of color in the same species as well as in the size of different individuals. Wing expanse 37-53 mm.

Caterpillar: The fully grown last instar larva is about three-fourths of an inch long and one-eighth inch wide, cylindrical, of substantially uniform diameter, with a skin somewhat roughened and pubescent. The oval head is of nearly the same diameter as the body, dull green in color, with numerous irregularly-shaped lighter spots on the dorsal half, the ocelli and the bases of some of the hairs being black. On the body, the prominent but narrow silvery or grey mid-dorsal stripe is laterally broadly bordered with chocolate brown. At the sides this breaks up into numerous spots on a golden yellow background, which midway to the silvery lateral stripes become so numerous as to form a continuous stripe, sharply limited ventrally by the golden yellow background. The lateral silvery stripes are narrowly above and scarcely at all below, margined with brown.

Below, posteriorly, and at the sutures, the body is dull green like the head, but somewhat lighter around the prolegs. The claws of the prolegs are brown; those of the true legs are semi-transparent green.

Chrysalis: The chrysalis is bluish-gray in color, with whitish bloom, smooth but not shining, wing pads prominent and rather sharply depressed posteriorly to meet the small abdomen.

Pupal period: 6 days.

Host: According to Wolcott's observations, the caterpillar of this species feeds on the foliage of "guayacán", *Guaiacum officinale* L. Apparently the caterpillars, during the hours of the day are hidden under the bark and crevices of the trunk, feeding only during certain hours of the night. Presumably in Puerto Rico the larva feeds on the same host tree, but due to its scarcity the butterfly is not commonly observed.

Anteos maerula (Fabricius)

(The Isandrina Butterfly)

This butterfly is more or less in the same situation as the preceeding, that is, nearly on the verge of extinction due to the scarcity of its host tree. The species has been recorded from Cuba, Jamaica, Hispaniola, Florida, Mexico, Central America and the northern part of South America.

Butterfly: The upper surface of wings is a uniform lemon yellow, except for a black spot at the end of the cell of the fore wing, and a similar light brown spot on the hindwing. The underside is faintly reticulated with yellow on a lighter background. The sexes are very similar. Length of f.w. 40 to 48 mm. (Bates, p. 139.)

Eggs: The eggs are laid on the leaves of the host tree. They are about 1.5 mm. long, spindle-shaped, with striations starting at the base and ending at tip, yellowish or light yellow in color. They are laid singly, never in groups.

Caterpillar: In the early stages the larva is velvety green, with body and head covered by minute dark blue spicules and a yellowish green stripe running dorsolaterally on each side of the body from the first thoracic segment to the anal segment. The fully grown larva measures about 4 cm. in length.

Chrysalis: The chrysalis is about 30 mm. long, green, shiny, with two brownish, nearly oval spots, about 2 mm. long and 1 mm. wide, on the wing pads. On the first abdominal segment invariably one finds 2 small brownish spots, with a separation of 6 mm. between them. The anterior end bears a small hook of a green and brown color, the brownish pattern extending from the hook, laterally to the anterior part of body for a distance of about 7 to 8 mm. The chrysalis is attached to twigs by means of a

tuft of silken hairs at its anal end, and also supported by two fine silken hairs around the abdominal segments, more or less going around the middle of the body of the chrysalis.

Pupal period: Around 6 days.

Host: Dr. Gundlach observed the caterpillar feeding on species of *Cassia*. The writer has found the caterpillar abundantly during the summer and fall months defoliating "vela muerto" trees, *Isandrina emarginata* (L.) Britton & Rose, at Salinas. Undoubtedly Dr. Gundlach saw the caterpillars on this same host tree, which formerly was known as *Cassia emarginata* L.

FAMILY NYMPHALIDÆ

Danaus plexippus (Linnaeus)

(The Monarch Butterfly)

This milkweed butterfly known as the Monarch is very common in Puerto Rico, abundant during the spring and summer months, especially at lower elevations, in the lowlands and on the hillsides. (Recorded by Möschler, p. 94 as: *Danaus erippus* Cramer; in IB, p. 397 as: *Anosia plexippus* Linn.)

Butterfly: The upper surface of the wings is bright reddish, with the borders and veins broadly black, with two rows of white spots on the outer borders and two rows of pale spots of moderately large size across the apex of the fore wings. The males have the wings less broadly bordered with black than the females, and on the first median nervule of the hind wings there is a black scentpouch.

Egg: The egg is ovate conical, ribbed perpendicularly with many raised crosslines between the ridges, pale green in color.

Caterpillar: The caterpillar is bright yellow or greenish yellow, banded with shining black, and furnished with black fleshy thread-like appendages before and behind.

Chrysalis: The chrysalis is about one inch in length, pale green, spotted with gold.

Host: The caterpillar of this species feeds on the foliage of the giant milkweed or "algodón de seda", *Calotropis procera* (Ait.) R. Br.

Hypanartia paullus (Fabricius)

(The Trema Caterpillar)

This is a fairly large butterfly, not very common in the Island, usually flying around in thickets and hillsides, at lower elevations but also found in the middle altitudes up to 2,000 ft.

Butterfly: The ground color above is brown, with some dark bands on the apical half of the fore wing of the male, and a double dark marginal band in both sexes. The hind wing is brown, with dark submarginal lines, and a black anal spot with some central blue scaling; this wing is toothed at M_3 and Cu_2 . The wings are more variegated on the under side, with various wavy lines of brown and silvery white. The male is darker than the female. Length of f.w., 27-32 mm. (Bates, p. 167). (See illustration of Plate XI.)

Caterpillar: Head either black or roughened with four kinds of cones; small black ones, medium-sized white or light-green ones, large light-green ones, darker at base and black at apex surrounding base of brown hair, and large black ones at top of head or darker green than body, with no black cones, altho some of the largest are black at apex. On the eighth abdominal segments on the anterior part of the body are seven yellow branched spines, often with apical half or two-thirds black or dark reddish-brown; four spines on the second and third thoracic and ninth abdominal; warts on the first thoracic. Body bright green below, with bluish grey bloom above. Spiracles white with faint black margin. True legs opalescent reddish brown. Prolegs covered with quite long white hairs. (IP, p. 140.)

Chrysalis: The chrysalis is light green at first with whitish pubescence, later light bluish gray; 6 golden spots dorsally, two on each side of the anterior abdominal segments, with brownish prominences on those posterior along the median ridge. Two sharp horns on head; proboscis, legs, antennae and wing-veins outlined in darker green. Brown circle with yellow center anterior of the cremaster ventrally. (IP, p. 141.)

Host: The caterpillar feeds on the foliage of "palo de cabra", *Trema micrantha* (L.) Blume.

Gynaecia dirce (Linnaeus)

A rare butterfly in the Island, recorded few times; at El Consumo (on the Mayaguez-Las Marias road, probably around 2,000 ft. in altitude) once more at Mayaguez but at low elevation. Also found in Hispaniola.

Butterfly: The upper surface is a quite uniform gray, except for the broad transverse yellow band of the fore wing. The underside has a zebra-like pattern of black lines on a creamy background. Length of f.w., 35 mm. (Bates, p. 174.)

Caterpillar: The fully grown larvae are from 30 to 35 mm. long, dull black, covered with white and yellow spines.

Habits: The larvae are gregarious, feeding voraciously on the leaves as well as the larger veins. The caterpillars feed for about 10 days, after which they pupate. Pupation period at Río Piedras: 13 days.

Host: According to Dr. Gundlach, the caterpillar feeds on the tough veins of the underside of the leaves of *Cecropia peltata* L., our common "yagrumo". Möschler (p. 97) in referring to this species says, "Scarce, in the borders of forests and sometimes in coffee plantations from November to January. Caterpillar on *Cecropia* and *Cassia fistulosa*." The second tree recorded by Möschler, undoubtedly is: *Cassia fistula* L.

Adults have been reared from material collected at Río Piedras (150 ft. in altitude) and from El Yunque Mountains (3,000 ft. high). On "yagrumo," *Cecropia peltata* L. (LFM.)

Timetes chiron (Fabricius)

A very common species; occurs almost everywhere in the American tropics. Recorded from Cuba, Texas, Mexico, Central and South America. Not abundant in Puerto Rico.

Butterfly: The wings above are usually quite dark, with four longitudinal light lines, the basal line not as clear as the others. The apex of the fore wing has five or six small white spots, that may be partially or wholly obscured (*chironides* Stgr.) The underside is very variable, usually silvery white basally, grey or brown on the outer half. The tail at M_3 is well developed. The females are sometimes lighter in color than the males. Length of f.w., 28–30 mm. (Bates, p. 171.)

Host: According to Dr. Gundlach, the caterpillar feeds on the foliage of "palo de mora", *Chlorophora tinctoria* (L.) Gaud.

Historis odius (Fabricius)

(The Yagrumo Butterfly)

This species which has been recorded from Florida, Cuba, Jamaica, Hispaniola, Central and South America, is rare in Puerto Rico. (Listed in IB, p. 400 as: *Historis orion* Fabr.)

Butterfly: The upper side is brown, heavily bordered with black, with a single spot in the apex of the fore wing; the underside is more variegated, marked with various lines and shadings. The large size and simple pattern of this butterfly make it unmistakable. Length of f.w., 52–65 mm. (Bates, p. 173.) (See Plate XI, for illustration.)

Caterpillar: Flattish, medium-gray, with white saddle 5 by 10 mm. at middle of back and two prominent projections, with spiny protuberances projecting upward and outward from the head, about 3 mm. long. In the fully grown caterpillar the saddle was greyer and less conspicuous.

Chrysalis: The chrysalis is reddish brown in color, with two double-curved projections 4 to 5 mm. long extending forward from the head and almost touching at their apex, but 2 mm. apart at base. (E. G. Smyth: IP, p. 143.)

Host: According to Dr. Gundlach the caterpillar of this butterfly breeds on *Cecropia*.

SUPERFAMILY HESPEROIDEA

FAMILY HESPERIIDÆ

Astraptes talus (Cramer)

(The Guaraguao Skipper)

This species has been recorded from all the islands of the Greater Antilles and in the continent it ranges from Mexico to Brazil. Not very common in Puerto Rico and nothing known about its habits. (Listed by Möschler, p. 107 as: *Eudamus talus* Cramer; in IB, p. 407 as: *Goniurus talus* Cramer.)

Butterfly: This species is distinguished from the related species, by the distinctly green vestiture of the body and basal part of the wings. The fore wing is crossed obliquely by a row of five translucent yellow spots. Length of f.w. 25 mm. (Bates, p. 209.)

Host: Dr. Gundlach recorded the caterpillar of this skipper as feeding on the foliage of "guaraguao", *Guarea trichiloides*.

Acolastus amyntas (Fabricius)

(The Ventura Skipper)

The species has a wide range of distribution in the American tropics and has been reported from all the Greater Antilles, also St. Thomas and St. Croix. In the United States it is found in Florida and Arizona. In Puerto Rico the species is becoming scarce with the disappearance of its host tree, few of which are still remaining in the Island.

Butterfly: The butterfly may be recognized by the rather uniform purplish brown ground color of the wings above, the lobed hind wing, and the three prominent translucent white spots on the disc of the forewing. Length of f.w. 21-25 mm. (Bates, p. 208.)

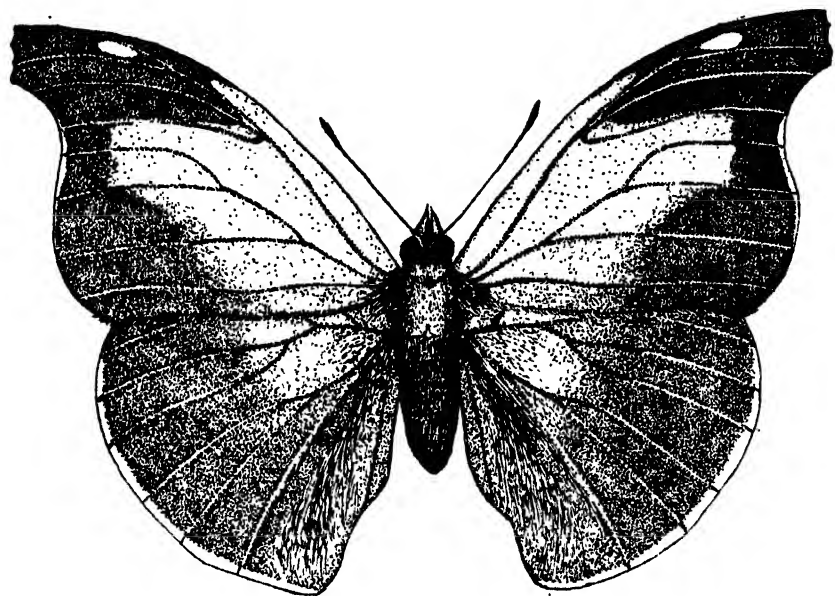
Caterpillar: The caterpillar has a flat, heart-shaped head, black in earlier stages or instars, lemon yellow in final instar with a large black spot on each of the dorsal cleft. (IP, p. 148.)

Host: In Cuba, Dr. Gundlach found the caterpillar on *Lonchocarpus domingensis* (Pers.) DC. In Florida the host tree is "ventura", *Piscidia piscipula* (L.) Sarg., the same host tree for Puerto Rico. Caterpillars

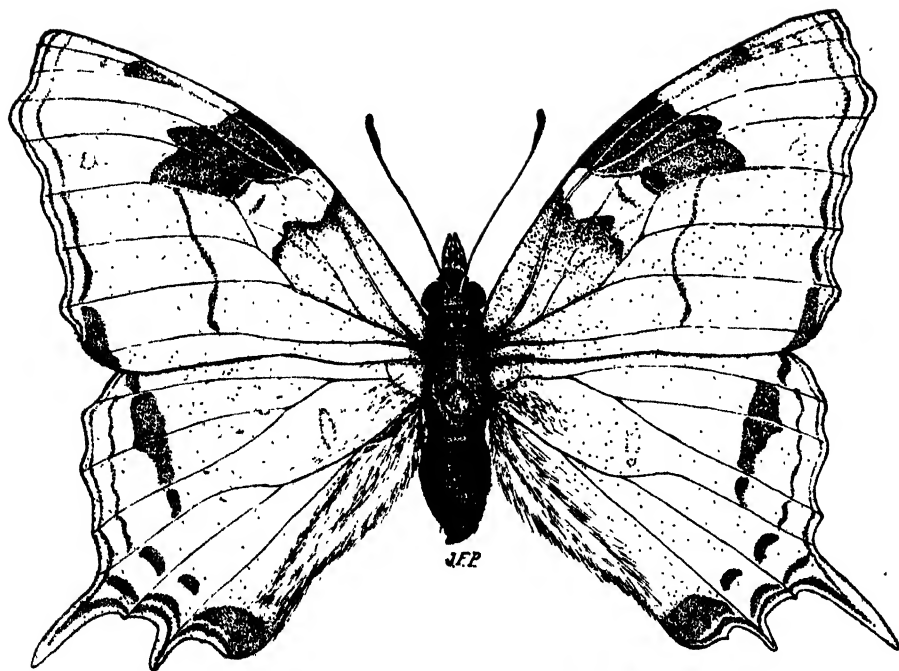
PLATE XI

Historis odius (Fabricius)

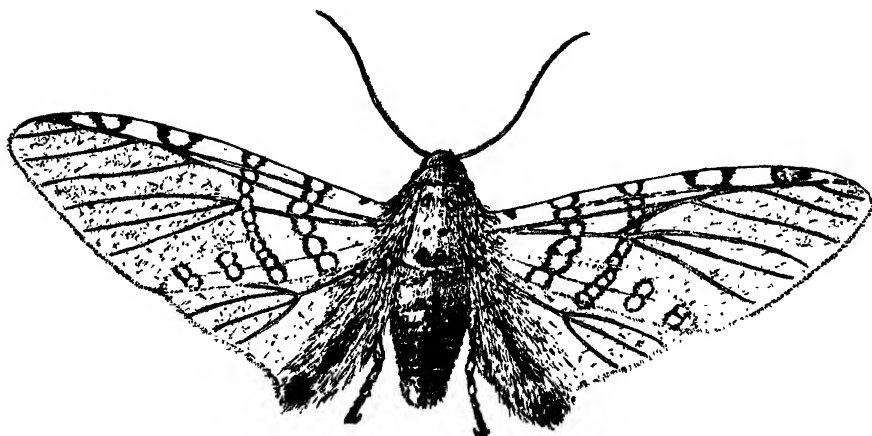
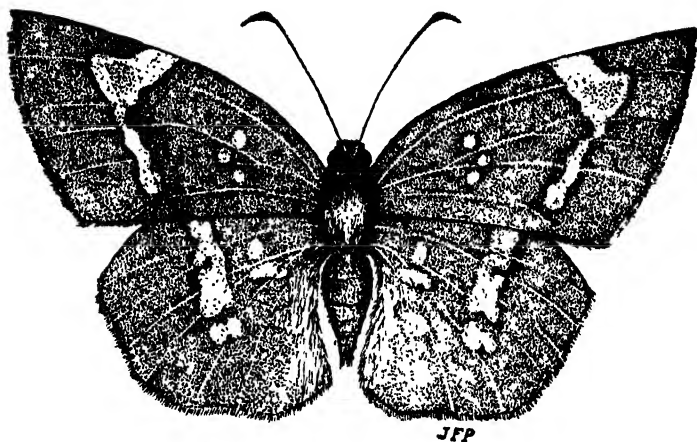
Hypanartia paullus (Fabricius)



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of this species have been collected at Punta de Cangrejos and Boquerón, where still some host trees grow.

Achylodes thraso (Hübner)

A fairly common species of skipper in Puerto Rico; also recorded from Texas to Paraguay and all the islands of the West Indies. (Listed in IB, p. 408 as: *Eantis thraso* Hübner).

Butterfly: A rather large, dark brown species, marked with spots and lines of lighter brown. Easily differentiated from other skippers by the very convex outer margin of the fore wing, the entire absence of white spots on the wings, and the prominent area of bluish scales on the outer margin of the underside of the hind wing. Length of f.w., 20–25 mm. (Bates, p. 213.) (See Plate XII, for illustration.)

Eggs: These are laid singly on the tips or on the undersides, near the edge of leaves.

Caterpillar: The head of the caterpillar is large, short, heart-shaped, in the earlier instars reddish brown, in the last instar greenish brown, with darker green narrow medio-dorsal stripe and broad lateral yellow bands made up to five irregularly rectangular spots on each segment. Neck and true legs yellow. Body in earlier instars is rounder and less tapering and with no indication of striping. (IP, p. 149.)

Chrysalis: The chrysalis is green, with a whitish bloom, easily rubbed off, protruding eyes, held in a silken girdle and by cremaster in a slight cocoon in a rolled leaf. It becomes dark bluish-purple a day previous to the emergence of the adult. (IP, p. 149.)

Host: Apparently the main host trees of this insect in the Island are those belonging to the genus *Citrus* (grapefruits, oranges, lemons, etc.) Sometimes they are so abundant that arsenate of lead sprays are used for their control. The caterpillar also feeds on the foliage of *Zanthoxylum monophyllum* Lam. Not very common in this tree. The insect is primarily a lowland type, very seldom observed at altitudes higher than 2,000 ft.

Brachycorene arcas (Drury)

This species is common in Puerto Rico, especially in the lowlands and on the hillsides. The insect has been previously recorded from Cuba, Jamaica, St. Thomas, St. Croix, Brazil, Cayenne, Panama and Central America.

PLATE XII

Achylodes thraso Hübner
Epantheria icasia (Cramer)

Butterfly: This skipper is distinguished from others by its immaculate, velvety, dark brown upper side, usually with a purple cast. Length of f.w., 18–22 mm. (Bates, p. 215.)

Caterpillar: The larva of this species, when fully grown is about 30 mm. long. Head, heart-shaped, short, broad ventrally, in earlier instars dark brown to piceous, roughly pitted subtending orange-colored hairs, with orange-colored markings; a large pair in front of the ocelli, a smaller pair behind, a dot above, a larger spot higher up and a broad band passing over the top of each side of the head; in last instar, light yellow in color with markings of chrome yellow as in earlier instars of orange; mandibles and ocelli shining dark brown. Body light green, approximating in color the underside of the leaves of the host plant, but darker in the middle and especially along the medio-dorsal line, nearly hemispherical in cross section, and held closely appressed to the leaf. The body color is made up of a ground work of gray-green, modified by numerous small bright yellow spots, which are confluent in two pairs of lateral lines, bounding the medio-dorsal line, and as latero-dorsal lines. Thoracic segments lighter in color, legs light yellowish green, spiracles bright yellow. (IP, p. 149–50.)

Chrysalis: The chrysalis is about 17 mm. long and 5.5 mm. broad. Shiny and glistening, with faint cocoon and well developed girdle, but well concealed in folded leaf. Light apple green in color, especially on the dorsum of the abdomen, where the yellow spots and four lines of the larva persist, elsewhere grayer, more cloudy and somewhat opalescent; head blunt with sharp corners and covered with transparent hairs, curved at ends; eyes opaque, white, subtriangular, margined posteriorly with black; venation of wings showing as faint white lines. (IP, p. 150.)

Host: The caterpillar feeds on the foliage of "olaga", *Malpighia fucata* Ker-Gawl. Adults were reared from caterpillars collected at Maunabo on this shrub.

Atrytone vitellius (Fabricius)

Quite a common species in Puerto Rico, also recorded from the Atlantic States, Gulf States and northward in the Mississippi valley as far as Nebraska and Iowa.

Butterfly: The male is small, with brilliant, shining, chrome yellow wings, margined with black, having a wing expanse of about 27 mm. The female on the upper side has the hind wings almost entirely fuscous, very slightly yellowish about the middle of the disk. The fore wings have the inner and outer margins more broadly bordered with fuscous than the male, and through the middle of the cell there runs a dark ray. On the

underside the wings are bright pale yellow, with the inner margin of the primaries clouded with brown. (Illustration of male in Holland 1914, Plate XLVI, fig. 6.)

Egg: The eggs are hemisphaerical, about 1.3 mm. in diameter, gray below, darker towards the apex, and marked with hexagonal reticulations.

Caterpillar: The larva when first hatched is light gray-green, so transparent that its internal organs are plainly visible, but becoming green, and more opaque as it grows. On the first segments there is a dorsal black band, terminating laterally just above a black dot, and the head is black, in the later instars. The fully grown caterpillar is 35 mm. long. The general color of the body is robin's egg blue, but looked at more closely is seen to consist of a lighter colored network surrounding numerous darker spots subtending small hairs. There is a darker medio-dorsal stripe, and the three anterior and posterior segments are somewhat more yellow-green than blue. The spiracles are yellow, and the true legs are also opalescent light yellow. On the dorsal half of the first segment is a black half-ring ending on each side just above a large black spot. The head is roughly granular, dull yellow, black where attached to the neck, around the outer edge, and in front in two broad straight vertical lines.

Chrysalis: The chrysalis is about 18.5 mm. long and 3.5 mm. wide, opalescent, creamy yellow on the wings, lighter on the abdomen, but a dull light red on the head, which also has many straight hairs, the rest of the chrysalis being faintly pubescent. (Notes on egg, caterpillar and chrysalis from Jones and Wolcott 1922, p. 42-3.)

Host: Mr. Francisco Sefn, reared male and female of this species, from caterpillars collected while feeding on areca palm or "nuez de areca", *Areca catechu* L.

Panoquina nero (Fabricius)

A common skipper in the Island, also reported from Hispaniola, Jamaica, St. Thomas, Central America and Cuba (where the form *silvicola* is the predominant local subspecies). (Listed by Möschler, p. 103 as: *Hesperia nero* Fabr.; in IB, p. 411 as: *Preues nero* Fabr.)

Butterfly: The adult is a dark brown, thick-bodied butterfly, with wings darker above than below and the ventral surface of the body nearly white. Of the seven, or less, white, semi-transparent spots on each of the fore wings, the largest is acutely triangular. The wing spread of the largest adult is 35 mm.

Egg: The eggs are hemispherical, about 1.8 mm. in diameter, and are laid singly on leaves. When first laid they are nearly white, becoming gray with age, often with a rosy tinge, and with the apex and a circle

about and just below it darkest. Under a lens the entire curved surface shows delicate reticulations, hexagonal in shape. The egg period is from 4 to 5 days.

Caterpillar: The mature larva is light green closely approximating the color of the underside of leaves. On closer inspection the surface is seen to be marked with pale, chrome yellow, transverse lines near the intersections of the segments, and four, light, longitudinal, dorsal lines. All markings more distinct at either end of the body. There are also numerous, very small, darker green dots and sparse short hairs. Below, the body is bluish green and laterally a white line extends along a slight fold just below the level of the stigmata.

Chrysalis: The chrysalis rests on a film of silvery silk, its ventral surface next to the leaf, and is held in place by a band of silk over the thorax and by several strands at the anus. It is translucent, light green, with a number of slightly wavy light lines extending lengthwise dorsally. Four extend the full length of the thorax and abdomen, converging at either end, and one each side, laterally, follow the line of the stigmata. Ventrally, especially the wing pads and undeveloped legs, and at either attenuated end, the pupa is more opalescent and less green. On the head projects a curved, conical tubercle or horn. The pupa or chrysalis is about 30 mm. long and 5 mm. wide. A day or two before emergence of the adult, the eyes of the butterfly in the chrysalis become bright pink. Later the entire chrysalis becomes dark purplish.

Pupal period: The pupal period required is ten to twelve days in those individuals kept under observation, while rearing at the laboratory. (Illustrations of larvae, chrysalis and adult, in Jones & Wolcott, 1922, p. 39-40.)

Insect Enemies: The larva or caterpillar is parasitized by two species of hymenopterous insects: *Ardalus antillarum* Gahan and *Apanteles prenidis* Musebeck. The caterpillar is also attacked by the vespid *Polistes crinitus* (Felton), the adult of which devours the caterpillars in the field. However, the most important enemy of *Panoquina nero* (Fabr.) is the egg parasite *Trichogramma minutum* Riley.

Host: In Puerto Rico, the caterpillar has been recorded as feeding on the leaves of *Bambos vulgaris* Schrad., our common "bambúa". However, its most important host plant is the sugar-cane, *Saccharum officinarum* L.

Perichares coridon (Fabricius)

Another fairly common species in Puerto Rico, which has a wide range of distribution in tropical America, the form *coridon*, probably being the Antillean chloromorph.

Butterfly: This species may be distinguished by the yellow, translucent

spots of the fore wing; a large, curved cell spot, smaller spots between M_3 and C_2 , and Cu_1 , and Cu_2 , a tiny spot, often absent on 2A. There are no subapical spots, and no markings on the upper side of the hind wing. The stigma of the male is narrow, curved and extends between veins 2A and Cu_1 , hardly differentiated from the rest of the wing in color. The hind wing, on the underside, is beautifully variegated with brown and violaceous; the underside of the abdomen is conspicuously marked with orange. Length of f.w., male, 22-23 mm.; female 26 mm. (Bates, p. 233.)

Caterpillar: The caterpillar is largely light green in color, although the head is black in the earlier instars and has a dirty appearance even later, but the caterpillar is most readily differentiated by the long, fine, whitish hairs which cover both head and body. (FEWI, p. 206).

Host: The caterpillar has been collected at Mayaguez, feeding on *Bambos vulgaris* Schrad., our common "bambúa". Its chief host plant however is sugar cane, *Saccharum officinarum* L.

SUPERFAMILY SPHINGOIDEA

FAMILY SPHINGIDÆ

Cocytius antaeus antaeus (Drury)

(The Giant Sphinx)

A rather common moth in Puerto Rico, also recorded from Florida, Cuba, Bahamas, Jamaica, Hispaniola, Central and South America, as far as southern Brazil. The insular form is *antaeus antaeus*, the continental is known as *antaeus medor*. The difference between the two is very slight. (Recorded as *Amphonyx antaeus* Drury, by Möschler, p. 111.)

Moth: The moth is large in size, robust, generally of a brown color, with some orange markings at the base of hind wing, the abdomen with a row of yellowish spots on each side. (Description of species in Rothschild & Jordan, p. 58; also color plate is shown in Holland 1913, Pl. VI, fig. 1.)

Egg: Elliptical, slightly flattened above and below, rounded, normal; shell white, thin, densely granular shagreened; probably green before hatching; size 2.4 by 2 by 1.8 mm.

Caterpillar: The last stage of the caterpillar is as follows: Head highly conical, but without the points observed in the earlier instars; vertex rounded, median suture impressed, clypeus very small, about one-fourth the height of head, vertical membranous triangle visible on the back, not reaching halfway to the conical apex; finely shagreened, also with minute, sparse, smooth granules and a very few secondary hairs toward vertex; green, slightly shining, a very obscure paler band up the anterior angles

from ocelli to vertex and a fainter one on occiput from base of vertical triangle; apices of lobes slightly yellowish; jaws black; labrum furcate, brownish; antennae mostly pale; ocelli brown, shaded, except the upper and lower ones; width 7 mm. Body large, robust, smaller before; anal plates large and thick; joint 12 enlarged dorsally with an enormous thick club-like horn, studded thickly with cones, the end rounded, not pointed. Segments 8- annulate, the ordinary granules minute, but the sparse ones distinct and pale with rather long and distinct brown secondary hairs, perfectly visible without a lens. Green, a dorsal vascular line shading into purple, bordered with yellowish posteriorly (joints 6 to 10), the lateral obliques very faint dark shades, lighter edged, except the one on joints 12-10, which is very distinct, broad, white line edged with dark green before. Horn olivaceous lilac above, the studding cones pale ochreous with brown tips. The three anal plates are rounded triangular, green, covered with large slightly elevated yellowish brown granules, faintly circled with yellow. Other abdominal feet green, the claspers black; thoracic ones yellowish white, streaked and spotted with black, with a few small whitish granules. Spiracles large, dark brown, shading paler above, and below, with a central vertical white line. Later the horn became dark violet above, the dorsal stripe violet, broad and distinct, narrowing anteriorly to obsolescence. The larva entered ground and formed a cell in the earth. (Dyar 1901, p. 257-8.)

Pupa: The pupa is long and rather slender, about 90 mm. in length, the eighth abdominal tergite with divided patch of tubercules.

Host: According to Dr. Gundlach, the caterpillar of this moth breeds on *Annona muricata* L. The insect is not abundant enough to be of economic importance.

***Protoparce rustica* (Fabricius)**

(The Rustic Sphinx)

A common species in Puerto Rico, distributed throughout continental tropical America and the West Indies. Also recorded from St. Jan. (Listed by Möschler, p. 110 as: *Sphinx rustica* Fabr.; in 1B, p. 445 as: *Phlegethontius rusticus rusticus* Fabr.)

Moth: The head and ends of palpi are blackish brown, with a short white dash on the vertex, and white spots at the base of the antennae; palpi beneath white. Thorax blackish with white spots on the disk, and tegulae at the base of anterior wings. Abdomen blackish brown, with a narrow blackish dorsal line, and three round orange-yellow spots margined with black on each side, and two rows of dorsal white spots. The under surface of the thorax and abdomen white. Fore wings blackish brown, or

ferrugineous brown; when faded, mottled with white; a few white spots at the base; the middle of disk crossed by two black lines and a brown one, which is margined on both sides with white, with serrated black lines traversing the nervules, margined broadly behind with brownish white; discal spot white, an irregular sub-terminal blackish line, with white marginal spots and a short, oblique apical streak, edged above with white; ciliae white spotted. Hind wings blackish, costa and disk yellowish, with a white spot near the base, and one above the inner angle crossed by black lines. (Morris 1860, p. 187.)

Caterpillar: The fully grown larva, in the height of its development after last moult, is five and a half inches long when fully extended, depth, dorso-ventrally, five-eighths of an inch. Head rounded; dark clear green two clear blue stripes from summit of centre of head in front diagonally down to basal outer corners of head. First three segments yellowish green, lighter above, with two dorsolateral lines composed of whitish yellow tubercules tipped with brown; these extend to beginning of fourth segment. A dorsal greenish blue-white line along centre of first four segments. Remaining segment shades from light pea-green (after quite yellow) down to dark clear blue-green below. From the line marking the beginning of the fourth segment and from a point opposite the stigma of that segment, an oblique yellow-white band, sharply cut, runs to near the top and rear of fourth segment, continued on over fifth segment, and ending in center of top of sixth, where it becomes nearly parallel with its fellow from the other side; after entering fifth segment this band changes to pinkish white, fainter on top of sixth: on its whole length it is sharply faced above with dark blue-purple (varying in some specimens to blue-brown) which fades into the light white-green of dorsum. The remaining six lateral oblique lines are *mutatis mutandis*, similarly arranged, only that the yellow band is brighter and wider and the dark facing above is more distinctly red-purple, than in the first line. The last of these lateral oblique bands, the seventh, ends at the base of the caudal horn, into the under portion of which the yellow band fades. Between and under each of these seven lateral bands, starting at beginning and near top of the last segment which each band covers, is a greenish parallel line converging with its fellow from the other side on the dorsum. Caudal horn clear yellow-green covered with yellow dark-tipped granulations. Anal lap edged with clear yellow-green. The oval stigmata whitish buff, thinly edged with black, with black central line. Rim of prolegs yellow, hooks black. True legs buff, black jointed. A central greenish blue interrupted dorsal line for whole length of body.

Pupa: The pupa varies in size from 2.7 to 3 inches in length and from .7 to .75 in diameter (at far end of wing). The "tongue case" is very stout, with a pear shaped swelling at the free end, which presses against

the median ventral line about five-eighths of an inch from anterior extremity of pupa. The color is shining black-brown. (Notes on pupa and description of fully grown caterpillar from Smyth Jr. 1900, p. 487-8; also color plate of stages of caterpillar are shown in same work.)

Host: According to Dr. Gundlach, the caterpillar of this species lives in "roble amarillo", *Tecoma stans* (L.) H. B. K.

Pseudosphinx tetrio (Linnaeus)

(The Plumeria Caterpillar)

A very common moth in Puerto Rico, distributed throughout tropical and subtropical America, from Florida to the West Indies and southward to Paraguay and southern Brazil. Listed by Möschler from St. Jan. The female of this species is probably the largest of American hawk-moths or sphingids.

Moth: The moth is large, with gray and brownish wings, the hind wings darker in color than the fore wings. The male usually has a triangular dark patch resting on the middle of the costa; the female is paler, much larger and without the patch. Wing expanse, 95-133 mm. (Description of the species in Rothschild & Jordan, p. 353-4; color illustration in Holland 1913, Plate VI, fig. 2.)

Caterpillar: When fully grown the caterpillar is about five inches in length, black, transversely striped with yellow to cream, with red head and tail. Very distinguishing and impossible to confuse with other Sphingid caterpillars.

Host: Dr. Gundlach, reported the larva on *Plumeria*. Mr. A. Busck, found the caterpillar in *Plumeria rubra* L. There are several records of the caterpillar in *Plumeria alba* L., at Guánica. The writer observed the caterpillars very abundant on *Plumeria obtusa* L. at Mona Island, causing total defoliation of some trees.

Pachylia ficus (Linnaeus)

(The Ficus Sphinx)

A common sphinx in the Island, also recorded from Florida, Texas, California, West Indies and South America as far south as Argentine.

Moth: A fairly large moth, wings olive-green in color with a conspicuous white spot on anal angle of hind wing. Very typical and easily distinguishable from other hawk-moths. (Description of species in Rothschild & Jordan, p. 373-4.)

Egg: The egg is laid singly, on the undersides of leaves.

Caterpillar: The middle and final instars show no essential differences, the ground color varying slightly in different specimens between light blue-

green and yellow-green. One very distinct mottled variety is herewith described: The dorsal area which is either the lightest or brightest portion, is enclosed by a couple of broad but tapering yellow bands from mouth to tail. The caudal horn is merely a short and hooked stump, light green in color, and the medio-dorsal stripe is represented by one or two spots of darker color on each segment. Unlike the oblique lateral stripes of the Acherontiinae, eight more or less ill-defined and rather narrow yellow lines mark the sides, directed headwards. Immediately beneath these are situated the spiracles which are dark ringed, but not very conspicuous. The legs are creamy pink and black ringed, and all the claspers possess a distinct fringe of hair. Head large and formidable, and together with plate and anal extremities of a light blue color inclining to violet. (Moss, 1912, p. 99.)

Pupa: The pupa is bright mahogany-brown, glossy, gracefully curved on ventral area. In general form robust and rounded, the cremaster being represented by only a very short blunt point.

Host: The caterpillar feeds on trees of the genus *Ficus*. Wolcott recorded the caterpillar feeding on "laurel de la India" *Ficus nitida* Thumb. and also on a related species, *Castilla elastica* Cerv.

SUPERFAMILY PHALAENOIDEA

FAMILY AMATIDÆ

Nyridela chalciope (Hübner)

This species which is not common in Puerto Rico, has been recorded from Cuba, Hispaniola and Jamaica. (Listed as *Isanthrene chalciope* Hübner, by Möschler, p. 113.)

Moth: The moth is blue with luteous antennae. Abdomen with lateral white dots. Wings limpid, margined with black. Fore wings with a black band. Morris, p. 264.)

Host: Nothing is known about the life history of this moth. According to Möschler, the caterpillar feeds on the foliage of "guara", *Cupania americana* L.

Horama pretus (Cramer)

This is a rather common species in Puerto Rico, and also has been recorded from St. Thomas, Santo Domingo, Jamaica, Cuba, St. John and Tortola.

Moth: The moth is fawn-colored, antennae banded with black. The first abdominal segment almost wholly pure white, the hind wings chocolate brown, fore wings testaceous.

Caterpillar: The fully grown larva is about 15 mm. long 7 mm. wide,

bright reddest orange, reddest on thorax and head, shining. Body clothed with numerous spreading tufts of gray and white hairs, curved towards their tips. On the seven anterior abdominal segments dorsally are four compressed tufts of black hair in pairs, bending towards each other, the anterior pair of each segment closer together and touching at apex.

Cocoon: The cocoon is made out of a thin gray silk with the longer hairs of the caterpillar entangled in it.

Pupa: The pupa is bright reddish brown in color. (Notes on caterpillar, cocoon and pupa, from IP, p. 414.)

Habits: The caterpillar of this species is a leaf-webber. They are gregarious and sometimes 8 or 10 larvae are found in one web. They seem to prefer the tender foliage at the terminal of branches, for this is the place where most of the webs are found on trees. The species is an insect of the lowlands, where its host tree grows best.

Host: The caterpillars web the leaves of "coscorrón", *Elæodendrum xylocarpum* (Vent.) DC.

***Correbidia terminalis* (Walker)**

This species is rare in the Island. It has also been recorded from the West Indies, from Mexico to Venezuela and presumably is present in the Guianas. In Puerto Rico the insect has been collected at middle elevations around 2,000 ft. (Listed in Möschler, p. 114 as: *Charidea cimicoides* Herr.-Schaff.)

Moth: The writer has not been able to find a description for this moth except for the notes on Forbes 1930 p. 27, where it says, "forewing with blackish band and apex. . . terminalis."

Host: According to Dr. Gundlach the caterpillar feeds on the foliage of "yagrumo", *Cecropia peltata* L.

FAMILY ARCTIIDÆ

***Eupseudosoma involuta* (Sepp)**

(The Snowy *Eupseudosoma*)

A fairly common species in Puerto Rico, also recorded from Cuba and from Florida to Brazil. (Listed by Möschler, p. 114 as: *Eupsodosoma niveum* Grt.; in IB, p. 415 as: *Eupseudosoma involutum* Sepp.)

Moth: The moth is white, with a brilliant red abdomen. (Color illustration in Holland 1913, Plate XIV, fig. 1.)

Egg: Slightly more than hemispherical, base flat, apex very slightly produced, suggesting the conoidal shape; clear yellowish green with amber lights about the edges, later opaque whitish green; reticulations small,

regular, rounded hexagonal, slightly raised, smaller just around the micropyle, forming a ring of small cells with one central one; micropyle eccentric, a little to one side of the vertex of the egg; diameter, 1.1 mm.; height, 0.5 mm. Laid several together or in a mass on back of a leaf, not touching, often rather remote and scattering.

Caterpillar: The last instar larva, has head pale yellow, a diffuse reddish shade over the face of each lobe, the paraclypeal pieces grayish and some gray dots on clypeus; labrum, epistoma, and antennae white; ocelli brown, jaws black at tip; the black U-shaped band entirely absent; width 3.5 mm. Body, thickly covered with a brush of yellow hair, even, spinulose, the ends pointed, not tufted; four slight and slender pencils of white hairs arise from the subdorsal warts of thorax. Body and warts pale yellow like the hairs, without marks. Later the head becomes dark orange red. Other larvae, alike till this stage, came out with variously colored hair; bright yellow, mouse gray, chocolate brown, and orange red, the color always residing in the distal third of the hair in the spinulose part, the head and bodies not affected being all alike in color. All the thoracic pencils were white. Later the color dulls so that there are only two forms, yellow and chocolate brown, which continue till maturity. (Dyar 1901, p. 261.)

Cocoon: The cocoon is composed of the hair felted in a delicate web of silk.

Pupa: The pupa is dark brown, concealed by the cocoon. (Notes on the caterpillar, egg, cocoon and pupa, from Dyar 1901, pp. 259-61.)

Host: In Puerto Rico, the caterpillar has been recorded on trees of the genus *Eugenia* and also in "guayaba", *Psidium guajava* L. However in Florida (United States) the host trees are: *Eugenia myrtiloides* Poir., and *Eugenia procera* (Sw.) Poir. The species is not of economic importance in the Island.

***Calidota strigosa* (Walker)**

(The Streaked Calidota)

A common moth in Puerto Rico and Mona Island, in this last locality very abundant at lights. The species is also found in Texas, Florida, Greater Antilles and St. Croix. (Listed by Möschler, p. 115 as: *Halisidota strigosa* Wlk.)

Moth: The fore wings are streaked with grayish markings, hind wings whitish to light gray. Abdomen dorsally red, laterally with dark brown markings. (Color illustration in Holland 1913, Plate XVI, fig. 24.)

Caterpillar: On its last instar, the caterpillar has a black shiny head, basal joint of antennae reddish, epistoma slightly paler at the sides, mostly black; width 4 mm. Body fleshy brown with vascular dorsal blackish

stripe; warts and hair light pinkish brown. Hair regular, dense, with numerous longer concolorous ones at the ends. White subventral band (above wart v) present in the incisures only, obscure. Feet reddish. The hair is densely spinulose; seen at right angles it is pale pinkish brown; seen obliquely it is much darker and more reddish brown.

Cocoon: The cocoon is elliptical, rather thin, composed of hair and silk, spun among leaves, not entirely concealing the pupa.

Pupa: The pupa is dark mahogany brown in color. (Notes on caterpillar, cocoon and pupa from Dyar 1901, p. 270.)

Host: In Puerto Rico, the caterpillar feeds on the foliage of prickle-wood, *Guettarda elliptica* Sw. Same host tree in Florida (United States.)

***Ecpantheria icasia* (Cramer)**

(The Tiger Moth)

A very common moth in Puerto Rico, collected at lower and higher elevations. The species is divided into many different races, scattered through Central and northern South America and the West Indies. (Listed by Möschler, p. 116 as: *Ecpantheria icasia* Cr. and *eridanus* Cr.; according to Mr. Van Zwaluwenburg 1916, p. 12 as: *Ecpantheria eridanus* Cr.)

Moth: The species is very variable, the female has sometimes white wings and orange abdomen, the male white wings with circular spots in transverse rows on the upper surface of fore wings, the hind wings with a nearly black streak near the inner margin. Abdomen orange with black spots. (See Plate XII).

Egg: The eggs are subspherical, slightly flattened on side of attachment. The shell is covered with fine, irregular reticulations and the color, when the egg is first laid, is greenish yellow with a pearly iridescence. Color changes to steel gray shortly before hatching. Size, about .50 to .75 mm. in diameter, slightly less in height.

Caterpillar: Mr. Van Zwaluwenburg describes 7 instars of the caterpillar, instars 7 and 8 being just like 6 except for the larger size of the head. Instar 6 is described as follows: The head is broader than high, indian red in color, width about 2.25 mm. A distinct inverted "Y" in pink on the face, clypeus small. Cephalic hairs coarse and light brown. Body black, tubercules indian red, all hairs except a few dark-brown ones on the thoracic segments, black. A rather conspicuous lemon-yellow spiracle surrounded by a black ring on all segments but the last two thoracic and the last abdominal. Thoracic legs reddish brown, prolegs dark.

Cocoon: The cocoon is a loose tough web of brown silk in which the larva molts for the last time.

Pupa: The pupa is rounded, elliptical, obtected; dark mahogany brown. Cremaster consisting of a group of short hairs each bearing a knob of spines at its tip. Female pupa 22 mm. long, 9 mm. broad, 14 mm. from tip of head to end of wing cases; male pupa somewhat smaller.

Habits: The eggs are laid in clusters, either on the upper or lower surfaces of leaves or on the trunk of trees. Usually it takes a long time for a female to lay all its eggs. They lay an average of 500 eggs. The egg stage varies from 6 to 8 days, the larval stage taking 30 to 35 and the pupal 15 to 20.

Natural Enemies: The dipterous insect, *Carecia amplexa* (Coquillett) (in IB, listed as *Exorista amplexa* Coquillett) has been reared from the caterpillar. The ichneumonid *Eremotylus angulatus* Hooker, also attacks the caterpillar.

Host: Egg masses have been found on the trunk of a young tree of *Cedrela odorata* L. at Villalba (Doña Juana Camp, 1900 ft. altitude) and the adults have been collected abundantly at lights in the same locality. Egg clusters have been also found on the foliage of "guayaba", *Psidium guajava* L. According to Mr. Van Zwaluwenburg the larva feeds on "lucare", *Erythrina micropteryx* Poepp. = *Erythrina poeppigiana* (Walp.) O. F. Cook.

FAMILY PHALAENIDÆ

Subfamily Acronyctinae

***Laphygma frugiperda* (Abbot & Smith)**

(The Fall Army Worm)

This is a common moth in Puerto Rico and well known in the United States, where it occurs from the Atlantic States to the Mississippi valley, south to Mexico, Central and South America and then to the West Indies and the Lesser Antilles.

Moth: This insect shows a considerable variation in coloration and markings. In one type the upper surface of the fore wing is gray-brown, with markings indistinct or lacking; in the other the fore wings are rather attractively marked with white, black, yellow-brown, red-brown, and pale blue. The hind wings are glistening white, bordered with gray-brown, both above and below. The body and the undersides of the fore wings are light gray-brown, darker on the upper side of the thorax.

Caterpillar: The caterpillar moults 6 or 7 times before becoming fully grown, and the total period to reach that stage is about 21 days or more. The general color of the caterpillar is olive-green, with darker stripes laterally and more transparent and greener, from the food seen within,

beneath. On the dorsum of each of the abdominal segments are four large dark spots which outline an isocles trapezium. These spots and an inverted Y of white, light gray, or light yellow, on the yellow brown head are constant characters by which the larva may be identified.

Pupa: Pupation takes place in the soil. The pupa is about 15 mm. long, glistening, dark reddish brown, rounded at the head end and pointed at the other. Pupal period from 10 to 12 days.

Habits: The moth is inactive and thus hidden during the day: the activities of flying, mating and egg laying being carried on during the night. The caterpillar feeds mostly at night, but when the food supply in one place becomes exhausted then it moves with its other companions in large masses, just like an invasion, and thus the common name of army worm. It is more abundant during the Fall and Winter seasons, especially during the rains after a period of drought.

Natural Enemies: *Laphygma* is attacked in Puerto Rico by a group of predators and parasites, among which the three larvaevorid flies, *Achaeotoneura archippivora* (Williston), *Phosocephalops grassicornis* (Fabricius) and *Pseudoarchylas incerta* Macquart are the most important in controlling the caterpillar. The eggs are laid on the head or thorax of the caterpillar and the young fly maggots, bore inside and eventually cause the death of the caterpillar. The parasitic wasp *Chelonus insularis* Cresson lays its eggs in the eggs of *Laphygma*, however, not destroying the egg, which resumes its normal activities and the caterpillar emerges but with a parasite inside its body which later as it grows kills him. Two other parasitic wasps also attack the caterpillar, *Apanteles marginiventris* (Cresson) and *Euplectrus* sp. The carabid, *Calosoma alternans* (Fabricius) and the assassin bug, *Zelus longipes* (Linnaeus) have been observed to prey upon the caterpillar in the field. Two entomogenous fungi, *Botrytis Rileyi* Farlow and *Empusa sphacrosperma* Thaxter are also parasitic on the caterpillars.

The blackbirds or Porto Rican grackle, *Holquiscalus niger brachypterus* (Cassin), the ani or "judío", *Crotophaga ani* (Linnaeus) and some species of lizards destroy many caterpillars and moths.

Applied Control: Wolcott, in EEWI, p. 211 says the following about control: "Because the caterpillars are so largely parasitized, their destruction artificially by the application of arsenical poisons when they are fully grown and have already done most of the damage of which they are capable, not only does not justify the trouble and expense, but is a positive evil. The parasites within their bodies perish when the caterpillar is poisoned, and by thus reducing the number of parasites, another destructive outbreak of caterpillars is hastened. If the poison is applied early, when the caterpillars are still small, or if they are collected by hand at this time,

before they have done any considerable damage, such control is desirable regardless of its effects on the parasites, because the plant is protected."

Arsenate of lead or calcium arsenate in combination with an adhesive mixture can be used in their control. The common baits having as a basis wheat bran, and water and using for poison white arsenic, paris green or arsenite of soda, can be used effectively in the field. (For these formulas, see Metcalf & Flint 1939, p. 254.)

Host: The caterpillar has been recorded attacking seedlings of *Eucalyptus robusta* Smith, ("eucalipto") at the U. S. Forest Service Nurseries, at Río Piedras.

Subfamily Acontiinae

Atethmia repanda (Fabricius)

A fairly common species in the Island, having a wide geographical range in distribution, from the Gulf States south to Mexico, Central and South America as far as Argentine, the West Indies and Lesser Antilles. (Listed by Möschler, p. 114 as: *Atethmia inusta* Guenée; in IB, p. 427 as: *Bagisara subusta* Hübner.)

Moth: The adult is generally of a brownish color, but there is a great variation in coloration among individuals. The wings are marked, but these markings are also very indistinct in some specimens while in others are plainly visible.

Host: Mr. E. G. Smyth collected the caterpillar on "zarcilla" *Leptoglottis portoricensis* (Urban) Britton & Rose. Possibly this is the host tree of this species.

Subfamily Sarrothripinae

Characoma nilotica (Rogenhofer)

(The Willow Leaf-webber)

A widely distributed species in America, Asia and Africa, collected several times in Puerto Rico and considered as somewhat abundant. (Listed by Möschler, p. 121 as: *Paraxia chamaeleon* Möschler; in Biol. Centrali-Americana, Het. 2:497 as: *Talpochares* (?) *laurea* Druce.

Moth: "Primaries dark grey, irrorated with darker scales, the base of the wing black in some specimens; secondaries semihyaline dusky brown; head, thorax, antennae and legs grey, the abdomen pale brown. Expanse three quarters of an inch." (Biol. Centr.-Am. Het. 2: 497.)

Caterpillar: The caterpillar is small, semi-transparent greenish white.

Host: The caterpillar feeds on the buds and webs together, the leaves of *Salix chilensis* Molina, our common willow, or "sauce".

Subfamily Catocalinae
Erebus odora (Linnaeus)
 (La Bruja)

This is a common species in the Island, also recorded from the southern part of the United States, Mexico, Central and tropical South America. Very abundant in the West Indies.

Moth: Undoubtedly this species is our largest Phalaenid, with a wing expanse of about 4 to 5 inches. The adult moths vary in color, but generally they are of a dark brown color in both wings as well as body with some markings on the wings. The female has a very characteristic white wavy band across the middle of both fore and hind wings, on the upper surface.

Host: The caterpillar of this species feeds on the foliage of the following trees: "caña fistula", *Cassia fistula* L., "samán", *Samanea saman* (Jacq.) Merrill., and trees of the genus *Ficus*. The first two species are listed as host trees by Möschler, the third is according to Mr. Van Zwaluwenburg's observations.

Eulepidotis addens (Walker)

A fairly common species in our mountain forests, the caterpillar living on the host tree, which is abundant at middle and higher elevations in Puerto Rico. This species is limited to the West Indies in its distribution. (Listed by Möschler, p. 194 and 195 as: *Palindia variabilis* Möschler and *P. variabilis* var. *obscura* Möschler.)

Moth: A small moth, olive brown in color, with rather peculiar markings on the wings. (See Plate X.)

Caterpillar: A small dark green, nearly dark brown caterpillar, fast in its movements and quite unrestful when taken outside of the web of leaves in which it lives.

Host: The caterpillar feeds on the tender shoots and leaves of "guaba", *Inga vera* Willd. It folds the leaves and sometimes makes a sort of a web in which it spends most of its time when not feeding. Sometimes 8 or 10 caterpillars are found in one of these webs. The only caterpillars observed by the writer, were collected at 2,000 ft. high at El Peñón del Collao, near Cayey, during an outbreak of this species. Presumably this insect is more abundant when the "guaba" trees begin to develop new shoots and leaves by the end of the Fall and beginning of the Winter.

Noropsis hieroglyphica (Cramer)
 (The Hieroglyphic Moth)

A common species in the Island, also recorded from the southern parts of the United States and tropical America. (Listed by Möschler, p. 149 as: *Noropsis fastuosa* Guenée.)

Moth: A small moth, with yellow fore wings crossed by blue bands and other markings near the outer margins. Hind wings of a grayish color. (See illustration in Holland, Plate XXVIII, fig. 1.)

Caterpillar: The full grown caterpillar is about 25 mm. long and about 4 mm. across the head. The ground color of the body is bluish or greenish white with a black stripe running around the body on each segment. The segments are divided from one another by a narrow black line. The anal plate and head are reddish brown, the collar shiny black.

Cocoon: The oval pupal case is about 22×10 mm. and is formed of parchment-like material on the stem of the food plant and is covered with grass and bits of leaves. (Notes on the caterpillar and cocoon, from IB, p. 435).

Host: Dr. Möschler records the caterpillar on *Corchorus siliquosus* L., which is just a shrubby herb. The fully grown caterpillars have been observed boring in the trunks of casuarina trees, *Casuarina equisetifolia* Forst., causing severe injury to young trees. Mr. Van Zwaluwenburg recorded the caterpillar as feeding on the foliage of the leguminous tree, *Leptoglottis portoricensis* (Urban) Britton.

***Pseudohemiceras krugii* Möschler**

Not a very abundant species in Puerto Rico, presumably endemic.

Moth: A small moth, with a wing expanse ranging from 31 to 38 mm., dark brown fore wings, white hind wings, some specimens with a broad, brown area around the outer margins of wings; thorax brown, abdomen white.

Host: Only recorded once, the caterpillar boring in the twigs of *Tabebuia heterophylla* (DC.) Britton (roble prieto.)

***Melipotis acontoides* Guenée**

(The Flamboyán Caterpillar)

A very common moth in Puerto Rico, also recorded from Texas, Arizona, Mexico, Guatemala and Colombia. (Listed by Möschler, p. 183 as: *Stictoptera penicillum* Herrich-Schaffer.) The moth is attracted to lights, many of the Puerto Rican records obtained in such a way.

Moth: The moth is small, with a wing expanse ranging from 33 to 42 mm., the fore wings grayish with darker markings, the hind wings white, with a broad dark gray, nearly black band on the outer margin. The coloration of the species is extremely variable.

Caterpillar: The fully grown caterpillar measures about 4.5 cm. long, dorsally and laterally grayish, ventrally yellowish or creamy. The head is about the same color of the rest of the body, two light gray or whitish lines with a separation of about 2 mm. run all the way dorsally from the

first thoracic to the last anal segment. The caterpillar moves very slowly and usually is very hard to see, because its color matches exactly with the color of the bark of the trunk where it usually rests.

Pupa: The pupa is about 4 mm. long by 1.5 mm. in width and of a reddish brown color. Pupation period: 10 days.

Host: The caterpillar feeds on the foliage of the "flamboyán", *Delonix regia* (Bojer) Raf. and on "palo verde", *Parkinsonia aculeata* L. When the larvae are abundant they cause tremendous ravages, defoliating hundreds of trees at the same time. This is usually a lowland insect and never has been observed at middle altitudes.

Melipotis fasciolaris (Hübner)

A species recorded from southern United States, Mexico, Honduras, Panama, Venezuela, Brazil, Cuba, Jamaica, Santo Domingo, Dominica, Puerto Rico and the Virgin Islands. Common in the Island, especially on the dry southern districts, where the adult have been collected abundantly at lights.

Moth: The moths of the genus *Melipotis* are very difficult to describe, due to its great variability in their coloration, the variegated pattern of their wings and the similarity between the different species in the same genus. (For illustration of this moth, see Holland 1913, Plate XXX, fig. 22.)

Host: The caterpillar feeds on the foliage of the *lignum vitae* or "guayaacán" trees, *Guaiacum officinale* L. Apparently the feeding takes place at night, during the day the caterpillars are resting under the bark of the trunk or in crevices. Adults were reared by the writer from caterpillars collected by Dr. Wolcott, June 1942 at the Guánica Insular Forest.

Melipotis januaris (Guenée)

(The Guamá Melipotis)

This species is widely distributed through tropical America. Not so common in the Island as the two preceeding species.

Host: Mr. Van Zwaluwenburg recorded the caterpillars feeding on the foliage of "guamá", *Inga laurina* (Sw.) Willd. Thousands of larvae on trees at Mayagüez, June 1917. Pupation takes place in the ground.

Melipotis ochrodes (Guenée)

(The Prosopis Caterpillar)

This is a very common species in Puerto Rico, perhaps the most common of all the species in the genus *Melipotis*. It is widely distributed in tropical America.

Moth: The species is very well illustrated in Holland 1913, Plate XXX, fig. 25, under the name, *Melipotis pallescens* Grote & Robinson.

Caterpillar: The caterpillar is apparently nocturnal in habits, during the day is hidden under the bark of trees and in crevices in the trunk or branches, or under the trash at the base of the trunk.

Host: The caterpillar feeds on the foliage of three tree species in Puerto Rico, all of which are abundant on the dry southern and southwestern districts: "zacilla", *Leptoglottis portoricensis* (Urban) Britton & Rose, bayahonda, *Prosopis juliflora* (Sw.) DC. and "mesquite", *Prosopis glandulosa* Torrey. In addition Wolcott lists also, *Prosopis pubescens* (IB, p. 436), but this tree is not listed by Britton in his list of the local flora.

***Anticarsia gemmatilis* Hübner**

(The Velvet Bean Caterpillar)

A very common moth in Puerto Rico, very widely distributed in the tropics, ranging from the southern United States to Mexico, Central America and as far south as Paraguay, also in the West Indies. (Listed by Möschler, p. 212 as: *Thermesia gemmatilis* Hübner; in IB, p. 437 as: *Thermesia gemmatilis* Hübner.)

Moth: The moth is grayish brown, although through a hand lens the wings have a peppered appearance, black specks showing on a lighter surface. A line, which may be either lighter or darker than the rest of the wing, extends from wing tip to wing tip, running half way up the wings so as to form a segment of a circle when the moth is at rest, with the wings arranged fan-shaped. This line, which is about a fourth of a millimeter in width, may be edged on each side with a parallel line which is lighter in color. The part of the wing on the caudal side of this line is of a darker brown than is the side nearest the head. Just below the line and near the abdomen there are two black dots on each wing. These are edged caudad, or toward the rear, with yellow, another sprinkling of black sometimes appearing caudad of the dash of yellow. The wings are bordered with a brown or yellow line, and are heavily fringed with gray or brown. On the underside of the wings is a row of white dots, consisting of seven dots on each wing. The row of dots appear about 2 mm. or a twelfth of an inch from the caudal end of the wings. Wing expanse 37 mm. (see illustration in IB, p. 437.)

Egg: The egg is slightly oval, 1 to 1.5 mm. in diameter and has a rather shiny appearance. These are deposited singly on the leaves of the host plants.

Caterpillar: The fully grown caterpillar is about 37 mm. long. The markings and coloration are variable. The ground color of the larva is

black or nearly black, although some specimens have a grass-green color instead of black. Dark stripes alternate with lighter and even with white ones, and run the full length of the body. A stripe in the middle of the dorsal part is always light, usually of a light green. This is bordered on each side with a broad dark stripe. From this to the ventral surface there may be one light stripe, or three light stripes alternating with dark ones. In the latter case the narrow dark stripe nearest the ventral surface is light brown. Spots around the setae or hairs, are not prominent, but they are still darker than the dark stripes. The ventral or under surface is never striped and is always dark. The legs are lighter in shade than the rest of the ventral surface.

Pupa: The pupa is of a dark brown color about 18 mm. long.

Habits: The egg hatches in three to five days and the young caterpillar starts feeding immediately. It is very voracious and when abundant can cause nearly total defoliation of plants attacked. Pupation takes place in the ground. When the caterpillar is fully grown, it drops to the soil, burrows its way in and pupates. (Notes on moth, caterpillar, pupa and habits, from Douglass 1930, pp. 684-690.)

Natural Enemies: Infestations of this caterpillar have been naturally controlled in the field by means of the fungus *Spicaria rileyi*. (Wolcott & Martorell, Feb. 1940.)

Host: The caterpillar feeds on the foliage of "gullito", *Agati grandiflora* (L.) Desv.

Gonitis praerupta (Möschler)

A species recorded from Puerto Rico and Cuba, very scarce in the Island. (Listed as *Anomis praerupta* Möschler in IB, p. 441.)

Moth: The adult moth has a wing expanse of about 45 mm. and is of a chocolate brown color.

Caterpillar: The fully grown caterpillar is green, about 2 inches long. Just before pupation it turns reddish. Pupation period is about 11 days.

Host: The caterpillar feeds on the foliage of "maga", *Montezuma speciosissima* Sessé & Moc. The insect is of no economic importance, due to its scarcity.

Gonodonta maria Guenée

This species is rare in Puerto Rico. It is distributed throughout tropical America (Mexico, Dutch Guiana and Brazil).

Host: The caterpillar feeds on the foliage of "cayur" (*Annona palustris* L.) = *Annona glabra* L. and *Oxandra lanceolata* (Sw.) Baill.

Gonodonta nitidimacula Guenée

(The Soot-soot Caterpillar)

A fairly common species in Puerto Rico, also recorded from St. Thomas, Cuba, Colombia and Jamaica.

Moth: The general color of the body of the moth is dark brown, the fore wings variegated with purple, the hind wings with a large yellow spot on the middle of each wing; head white with black eyes. (See Plate XIII.)

Caterpillar: The caterpillar is entirely velvety black except for yellow clypeus, two bright yellow semicircular spots on the sides of the first segment, two narrow reddish orange spots on the fourth segment and two small yellow spots dorsally, two small reddish orange spots on the sides of the seventh segment, four larger on the eighth, two large ones on the ninth and tenth and two small ones on the eleventh, all lateral, and two large crescents on the hump of the twelfth, dorsally. (IP, p. 176.)

Pupa: Fairly large, shiny, dark reddish brown. Pupation period 11 days.

Habits: The moth is never seen during the day, but is attracted to lights at night. The caterpillar is very plainly seen due to its velvety black color and its conspicuous orange markings. It feeds voraciously on the foliage of the host plant, one often finding three or four of them on a single leaf.

Host: The caterpillar feeds on the foliage of soot-soot or "higuillo de limón", *Piper amalago* L. (Also listed as *Piper medium*). Very abundant during certain seasons of the year in the mountains south of Cayey (1,200 ft. altitude) and at the Guajataca Gorge, near Quebradillas.

FAMILY NOTODONTIDÆ

Hippia insularis (Grote)

Very rare in Puerto Rico, also recorded from Cuba, Jamaica and Mexico.

Moth: Primaries dark brown, thickly speckled with minute black dots, and with a small spot at the end of the cell, a light brown colored patch beyond the cell, and a whitish streak at the apex (but considerably smaller than in any other described species of *Edema*); secondaries dark brown, palest at the base, the fringe whitish; the underside of both wings dark brown, shading to very pale fawn-colored in front, dark grayish brown behind, beneath and the sides pale greyish brown; tegulae dark greyish brown; abdomen above dark greyish brown, beneath and the sides pale greyish brown; legs dark brown, antennae and palpi dark reddish brown. Expanse 1.25 inches. (Biol. Centr.-Amer. Lep. Het. 1:235, described as:

Edema mandela Druce; also illustration of adult in Möschler, 1886, fig. 30.)

Host: According to Dr. Möschler, the caterpillar of this species feeds on the foliage of "guara", *Cupania americana* L.

SUPERFAMILY GEOMETROIDEA

FAMILY GEOMETRIDÆ

Melanchroia cephise (Cramer)

(The Grosella Moth)

A very common moth in Puerto Rico; widely distributed throughout tropical America, recorded from Arizona, Florida, Mexico, Guatemala, Honduras, Costa Rica, Panamá and from Colombia to Argentine.

Moth: Dark grey with white band on apex of fore wings. (Illustration in Holland 1913, Plate XLII, fig. 19.)

Host: When the caterpillars are abundant they cause tremendous defoliation on "grosella" trees, *Cicca disticha* L.

Asellodes fenestraria Guenée

Although this species is widely distributed through tropical America from Mexico to Brazil, is not common in the Island. Also recorded from Cuba. (Listed in IB, p. 453, as: *Hydratoscia fenestraria* Guenée.)

Caterpillar: The caterpillar has a dark purplish brown head and five large irregularly rectangular spots of this color on the anterior abdominal segments, alternating with areas of dull green (the ground color) of approximately the same size, with small purplish spots on the second and third thoracic segments, and smaller purplish spots on the other segments. (IB, p. 453.)

Host: According to Mr. Van Zwaluwenburg, the caterpillar of this species lives on "jagua", *Genipa americana* L.

SUPERFAMILY PYRALIDOIDEA

FAMILY PYRAUSTIDÆ

Eulepte concordalis Hübner

(The Roble Leaf-webber)

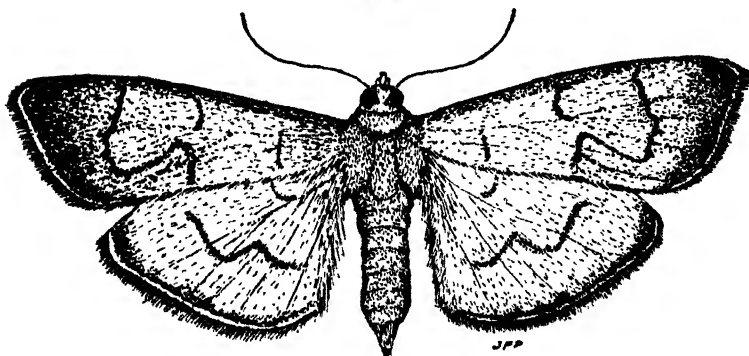
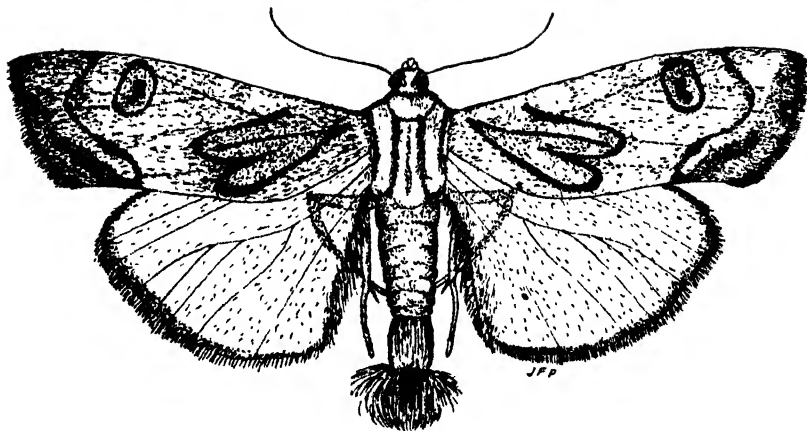
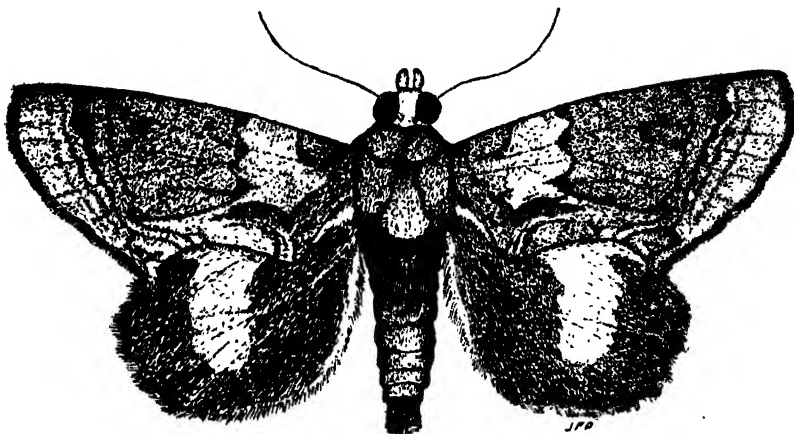
A very common moth in the Island, also widely distributed throughout tropical America, recorded from Cuba, Haiti, Virgin Islands, Dominica.

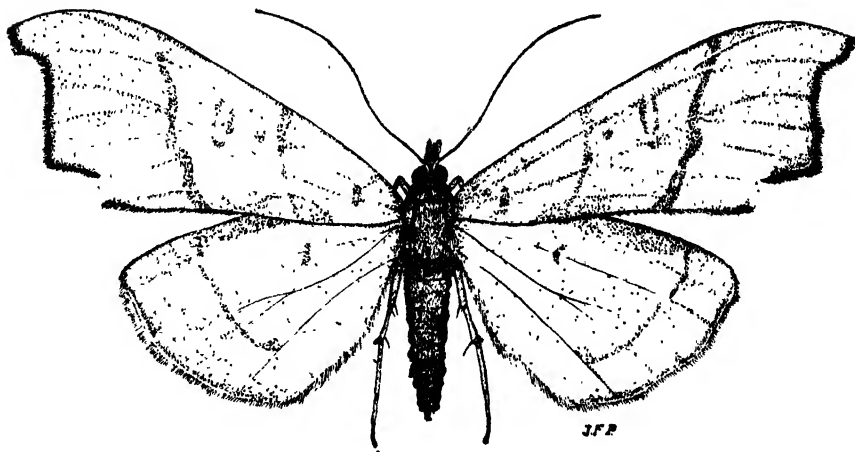
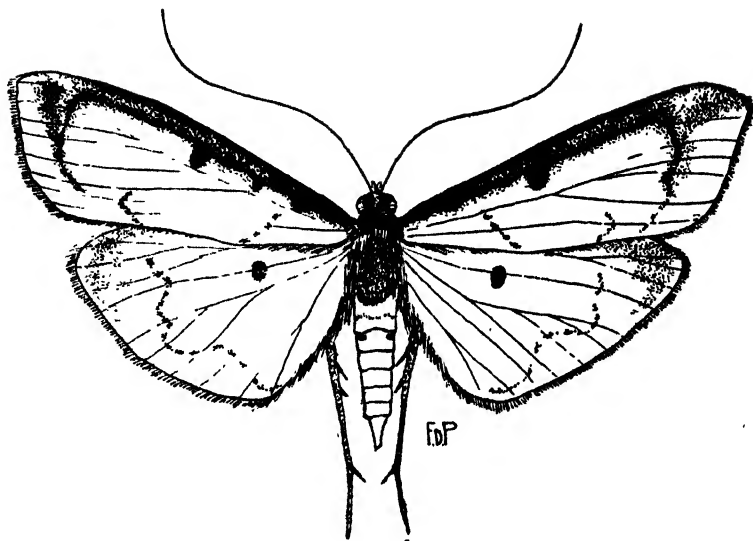
PLATE XIII

Gonodonta nitidimacula Guenée

Dichogamma redtenbacheri Lederer

Sylepta silicalis (Guenée)





Guadeloupe, Mexico, Guatemala, Panamá, Venezuela, Dutch Guiana and Brazil. (Listed by Möschler, p. 294 as: *Acrospila concordalis* Hübner and *A. gastralis* Guenée; in IB, p. 459 as: *Mesocondyla concordalis* Hübner.)

Moth: The species is very variable in size and color, some individuals are pale hyaline yellow, others bright yellow with the dark markings on the wings and body very distinct. In general the moth can be described as follows:

The moth has a wing expanse of 25 to 30 mm., is light yellow with some iridescence on its wings. The costal area of the fore wing and the anterior part of the thorax are purplish brown. The costal area of the hind wing is nearly white; a very prominent brown spot is located on the outer portion of the discal cell, just crossing the discal vein; apex marked with a brown spot. Abdomen yellow, with two small brown spots on the dorsal part of the second segment. Eyes black, antennae filiform, yellowish, with basal part light brown. (See Plate XIV.)

Caterpillar: When fully grown the caterpillar is of a shiny dirty-green color, its translucent body giving it a somewhat slimy appearance.

Pupa: The pupa is very variable in color, ranging from light to dark brown, about 15 mm. long and 3 mm. wide. Pupation period 8 days.

Habits: The caterpillar is a leaf-webber and causes tremendous defoliations when it becomes abundant. Its system of feeding is very peculiar, destroying only the epidermis of the leaf instead of feeding on the entire leaves as most caterpillars do. Trees attacked show many skeletonized leaves, most of them in bunches, webbed together. The caterpillar usually remains, among the webs and when the food supply is exhausted, it moves and makes another web of fresh leaves, so repeating, until it becomes fully mature and ready to pupate. Pupation takes place among the leaves, and only a very fine and delicate silken web or cocoon is spun around the pupa. This web is easily broken at the slightest touch.

Eulepte is found at low altitudes as well as at middle and higher elevations. Personal observations made by the writer demonstrate that the insect is more abundant during the Fall and Winter in the lowlands and during the Winter at middle and higher elevations.

Natural Enemies: The caterpillar is attacked by the larvaevorid flies, *Argyrophylax albicincta* (Wiedemann) and *Carcelia flavirostris* van der Wulp. This last record was obtained from a specimen in the collection at the U. S. National Museum, labeled, "from caterpillar on calabash tree, at Mayaguez, Jan. 5, 1912; coll., Hooker." The chalcid, *Brachymeria*

PLATE XIV

Eulepte concordalis Hübner
Sparagmia gigantalis Guenée

incerta (Cresson) and the braconid *Microbracon cushmani* Muesebeck, are also important parasites of this pest.

The following observations were made on the biology of the braconid, *M. cushmani* Muesebeck. The larva of the braconid is small, creamy, about 3 mm. in length, when fully grown. Before pupation it changes in color from creamy to grey and dark grey, nearly black. A fine silken cocoon is spun by each larva and this is attached to the leaf of the host tree by means of silken hairs. Usually all the cocoons are close together in a bunch of 15 to 20 according to the number of larvae feeding on each caterpillar. The pupation period is about 8 days at the end of which the adult parasites emerge. The parasitic wasps are from 2.5 to 3 mm. long, thorax and legs reddish brown, abdomen yellowish with light brown markings on the dorsal part of the first three abdominal segments. Wings smoky, eyes and antennae black, making a nice contrast with the light brown head. From 15 to 20 adults have emerged from a single caterpillar. (Notes on moth, caterpillar, pupa and natural enemies, from Martorell, Oct. 1940, pp. 18-19.)

Host: The caterpillar feeds on the foliage of the following trees:

<i>Crescentia cujele</i> L.	"higüera"
<i>Spathodea campanulata</i> Beauv.	"tulipán africano"
<i>Tabebuia argentea</i> (Bur. & Schum.) Britton	"roble de plata"
<i>Tabebuia heterophylla</i> (DC.) Britton	"roble prieto"
<i>Tabebuia lucida</i> Britton	"roble de mona"
<i>Tabebuia pallida</i> Miers	"roble"
<i>Tabebuia rigida</i> Urban	"roble de sierra"
<i>Tabebuia schumanniana</i> Urban	"roble colorado"

***Conchylodes diphteralis* (Geyer)**

(The Capá Prieto Leaf-webber)

Not a common species in Puerto Rico, also recorded from Cuba, Jamaica, Hispaniola and the Virgin Islands. (Listed by Möschler, p. 315 as: *Ledereria diphteralis* Hübner.)

Moth: The moth is white, with many black markings on the wings and body. Wing expanse 27 to 29 mm. (See Plate XV.)

Caterpillar: The fully grown caterpillar is 25 to 30 mm. long and 3.5 to 4 mm. in width, shiny dark green dorsally and laterally, light green ventrally. Body in general is transparent, the inside organs visible through the fine outer integuments. Two very conspicuous whitish lines run all the way longitudinally from the head to last body segment, these becoming very faint on reaching the last segment. These two lines are about 2 mm. apart and run dorsally. Thoracic legs dark brown nearly

black, prolegs and anal legs fleshy, light green in color. Head 2 mm. in width, shiny, epicranium dark brown with a mottled whitish pattern, front dark brown, clypeus grayish, mouth parts brown, antennae brown and gray. Cervical shield on first segment dark brown, with two whitish lines, really the beginning of those running all the way dorsally and longitudinally to the anal segments. Spiracles brown, plainly visible, especially those on the first thoracic segment. Dorsal markings on thoracic segments 2 and 3 are similar, each segment having two small spots of a dark brown color, somewhat circular in shape, surrounded by a whitish ring, each spot bearing two silvery setae. These spots are placed between the two longitudinal-dorsal lines, the outer end of each just touching the line. From segment 4 to 11 the pattern is changed and here four circular spots occur on each segment, arranged in a sort of a square, the pair in front larger than the posterior. These spots are also dark brown, nearly round, surrounded by a whitish line, each spot bearing a silvery setae and their outer edge just touching the longitudinal line on the dorsal part of body.

Pupa: The pupa is about 15 mm. long, shiny, reddish brown in color. Pupation period 12 to 13 days.

Habits: The caterpillars are leaf-webbers, gregarious in habits, sometimes 15 to 20 are found in a bunch of leaves webbed together in a large mass. Just before pupation the caterpillar cuts a section of a leaf, folds it back and makes a sort of an elongated, nearly oval-shaped cocoon about 20 to 25 mm. long and 8 to 10 mm. wide. A fine silken cocoon is spun then inside this bag, where pupation takes place. Usually the operation of forming the cocoon takes place 3 or 4 days before pupation begins.

The only caterpillars that have been reared to adults by the writer, were collected at El Peñón del Collao, about 1,900 ft. altitude, Oct. 1940.

Host: Dr. Gundlach recorded the caterpillar of this species from trees of the genus *Cordia*. The only record for Puerto Rico so far, is on *Cordia alliodora* (R. & P.) Cham., our common "capá prieto".

***Dichogama fernaldi* Möschler**

(The Burro Caterpillar)

A fairly common species in Puerto Rico, also recorded from Vieques Island.

Moth: The front wings are brownish with a reddish tinge, hind wings whitish with a pinkish tinge, abdomen and anal tuft golden brown. Wing expanse about 20 mm.

Habits: The caterpillar is a leaf-webber and at the same time a pod-borer, causing tremendous damage when it becomes abundant. Pupation takes place either inside the pods or between the leaves.

Host: The caterpillar feeds on the pods and foliage of "burro", *Capparis flexuosa* L.

Dichogama redtenbacheri Lederer

(The Capparis Leaf-webber)

A fairly common species in our lowlands, especially in the southern and southwestern districts of Puerto Rico. Also recorded from Florida, West Indies, Virgin Islands, Mexico and Perú.

Moth: The species shows a great deal of color variation on the wings, but in general it is a very light yellow, the front wings with a peculiar pattern which in some individuals is very clear and in others almost obsolete. Wing expanse 25 to 33 mm. (See Plate XIII.)

Habits: The caterpillar of the species is a leaf-webber. Pupation takes place among the leaves inside the webs. The caterpillar is more abundant during the Fall and the beginning of the Winter. Although typically a lowland type, sometimes it is found at middle elevations.

Host: The caterpillar feeds on the foliage of "palinguán", *Capparis flexuosa* L. and "burro blanco", *Capparis portoricensis* Urban.

Dichogama gudmanni von Hedemann

(The Capparis Pod-borer)

A common species in the Island, also recorded from the Virgin Islands. Observed in the lowlands, particularly along the coast.

Moth: The moth is white, the front wing with an orange band on the outer margins and brownish transverse markings across the wing. Hind wings are white. Anal tuft yellow or orange. Wing expanse ranging from 25 to 28 mm. (See Plate XVI.)

Habits: The caterpillar is a leaf-webber and a pod-borer, destroying an enormous amount of pods. When abundant it causes heavy defoliation, particularly in small trees.

Host: The caterpillar feeds on the pods and leaves of "burro prieto", *Capparis cynophallophora* L.

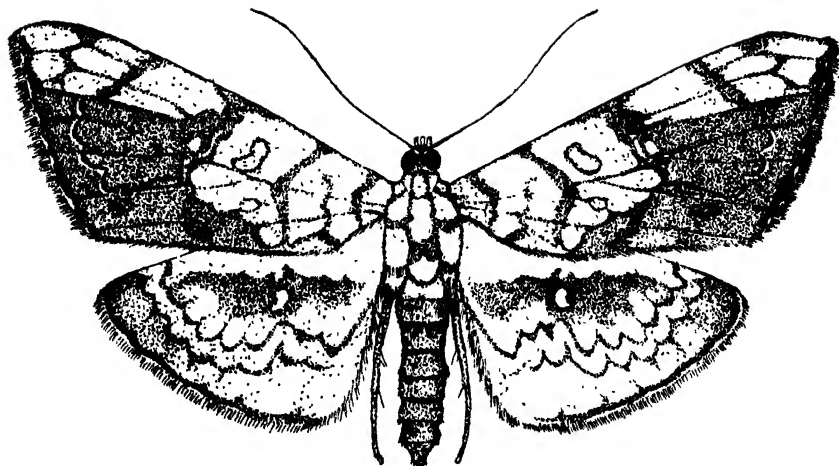
Phostria humeralis (Guenée)

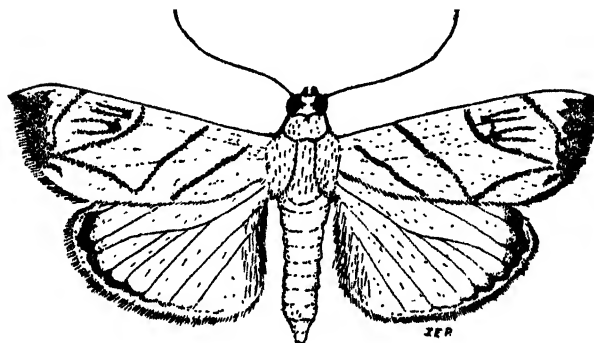
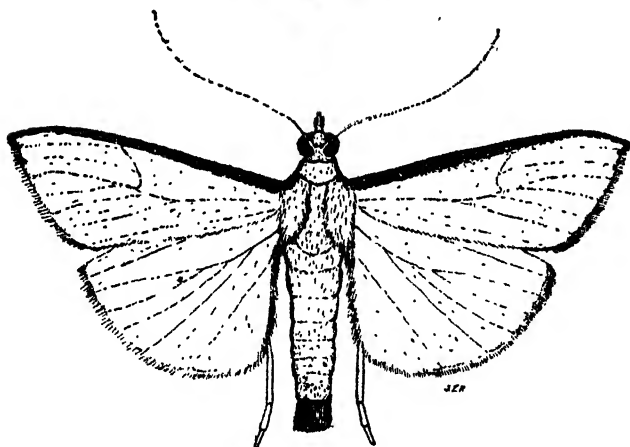
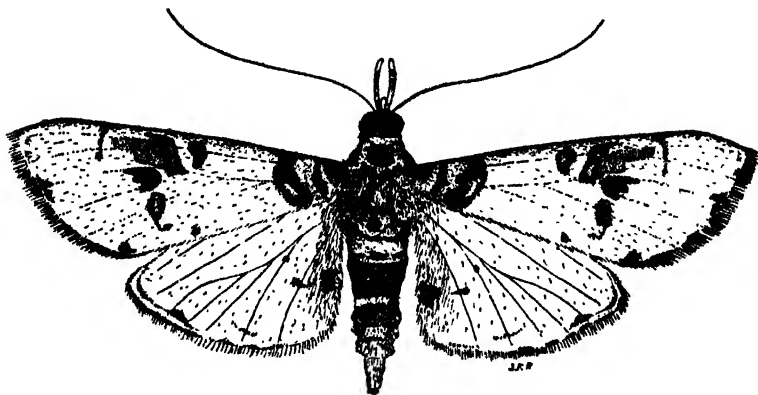
A rare insect in Puerto Rico, found also in other parts of tropical America, Haiti and Colombia. (According to Möschler). (Listed by Möschler, p. 301, as *Omiodes humeralis* Guenée).

PLATE XV

Conchylodes diptheralis (Geyer)

Pantographa limata G. & R.





Moth: The moth is dark brown with darker transverse markings on both wings, anal tuft brown, wing expanse ranging from 24 to 34 mm.

Host: The caterpillars web three or four leaves together and then feed on them; when these are eaten the process is repeated. Collected while feeding on "guaba", *Inga vera* Willd., at 2,000 ft. in altitude, near El Peñón del Collao. Apparently the caterpillars are more abundant during the beginning of the Winter.

***Phostria martyralis* (Lederer)**

(The Lonchocarpus Leaf-webber)

A fairly abundant species in Puerto Rico; also recorded from Cuba and Brazil. (Listed by Möschler, p. 300 as: *Coenostola martyralis* Lederer.)

Moth: The adult moth is of a reddish brown or rust color, fore wings sharply pointed, three fine irregular transverse bars cross both fore and hind wings, the bar towards the outer margin not crossing the hind wing, but only the fore wing. These bars or stripes are of a dark brown color and are very conspicuous. A noticeable yellowish fringe surrounds the outer and anal margins of the hind wings and the outer margin of the fore wings, making a nice contrast with the reddish brown color of the wings. Eyes brown, legs light brown and white, wing expanse from 21 to 23 mm. (See Plate XVIII.)

Caterpillar: The caterpillar when fully grown is about 20 mm. long, green, shiny, transparent, the body sparsely covered by small silvery setae; legs green; head yellowish brown, with one black dot on the middle of each epicranium close to the adfrontals; ocelli black, antennae and mouth parts yellowish brown. On the first thoracic segment just above spiracle there is a small longitudinal black spot.

Pupa: The pupa is brown on its dorsal aspect and greenish brown on the ventral side of the thoracic region, light brown on the ventral abdominal area, about 12 mm. long. The pupa is attached by its anal end to the leaf by means of a very fine silken hair.

Habits: The caterpillar is a leaf-webber and lives among the webs, using this also as a place for pupation. In the field numerous pupae can be collected just by looking in these webs. The larva is more abundant during the first part of December, when serious outbreaks occur. The caterpillar spins a very fine silken cocoon around its body just before pupation, taking a reddish color and then pupating within one or two days.

PLATE XVI

Azochis rufidiscalis Hampson
Diaphania costata (Fabricius)
Dichogamma gudmanni Hedemann

Natural Enemies: The caterpillar is attacked by a parasitic wasp of the genus *Apanteles*. Sometimes, in looking in the webs, one may find three or four of the white silken cocoons of the parasite and no pupa at all. These cocoons are very typical of *Apanteles*; white elongated-oval, about 4 mm. long, attached to the leaf by means of very delicate silken hairs. The parasite itself is about 2 mm. long, all black except for black and brown legs, wings hyaline, antennae filiform, black, and in the females the ovipositor is about 1 mm. in length. Quite a number of caterpillars are destroyed by the parasite, but unfortunately the parasite itself is parasitized by another parasitic wasp. The hyperparasite in this case belongs to the genus *Syntomosphyrum* of the Family Tetrastichidae. More than two or three of those minute hyperparasites emerged from each *Apanteles* cocoon. These are about 1 mm. long, all black except for brown and black legs, antennae short, wings transparent and iridescent.

Host: The caterpillar feeds on the foliage of *Lonchocarpus domingensis* (Pers.) DC. and *Lonchocarpus latifolius* (Willd.) H.B.K., commonly known as "genogeno" and "hediondo" respectively.

***Phostria originalis* (Lederer)**

(The Moca Leaf-webber)

This species is not common in the Island, found only at higher altitudes during the coldest season of the year, very sporadic and not seen sometimes for years.

Moth: The moth is brown with transverse dark brown markings on both fore and hind wings. The anal tuft is brown and whitish. Wing expanse from 22 to 26 mm.

Caterpillar: The fully grown caterpillar is about 19 mm. long and 3 mm. in diameter, dark green color, with several markings and spots over the body and two yellowish lines running longitudinally from head to anal segments on each side of the body.

Pupa: The pupa is dark reddish brown, about 14 mm. long and 3 mm. in diameter. Pupation period, about 10 days.

Habits: The caterpillar is a leaf-webber and when abundant causes nearly total defoliation of the trees attacked. It makes large webs and among them one can find 30 to 40 caterpillars. When the food is exhausted in one of these webs a new one is made, and so on. Often on looking at a tree the only thing one can see is the bare branches and twigs and several of these webs scattered around among the bare twigs. Pupation takes place inside these webs. By the time the caterpillar is ready to pupate it spins a very delicate silken cocoon around itself, becomes very slow in its movements, changes to a yellowish color and pupates. The

pupa at first is of a greenish color, in a day or so changing to brown, light brown, or dark reddish brown. There is a great variation in the coloration of the pupae.

The caterpillars are not common and apparently they are only abundant during the coldest season of the year. Sometimes they are seen every two or three years. They seem to prefer the middle or higher altitudes and never have been observed at lower altitudes where their host trees are abundant.

Host: The caterpillar feeds on the foliage of "moca", *Andira jamaicensis* (Wright) Urban.

***Blepharomastix ebulealis* (Guenée)**

(The *Heterotrichum* Leaf-folder)

Not a common species in Puerto Rico; also recorded from the United States, South America and the West Indies. (Listed in IB, p. 460 as: *Lamprosema ebulealis* Guenée.)

Moth: The moth is yellow with brown markings across the wings, eyes black, antennae yellow, 2 characteristic black spots present on the dorsal part of the third abdominal segment, just at the end of second, legs silvery or white.

Caterpillar: The full grown caterpillar is about 13 mm. long, light green color, shiny and translucent.

Pupa: Pupation takes place on the leaves of the host plant. The pupa is small, about 8 mm. long and of a chestnut color.

Habits: The caterpillar although small is a very voracious feeder. It folds the leaf or sometimes webs two or three leaves together, feeding at the same time on the foliage. Sometimes one may find three or four folds in a leaf and in each a small caterpillar of this species. The species seems to thrive best at middle altitudes. The only specimens reared were from caterpillars collected at El Yunque Mountains, 1,900 ft. altitude. At the time many trees were infested by the larvae, but unfortunately nearly all were parasitized by larvaevorid flies.

Natural Enemies: On examining the folds on the leaves, several puparia of flies were collected and when reared and identified were: *Leskiopalpus flavipennis* (Wiedemann). The puparium was reddish brown and about 6 mm. long. The adult fly is about 6 mm. long, black eyes and antennae, yellow-brown abdomen, the legs yellow brown and black, wings hyaline, body densely covered by hairs or setae especially on the abdomen. This fly seems to be an efficient natural control for this insect.

Host: The caterpillar feeds on the foliage of "terciopelo", *Heterotrichum cymosum* (Wendl.) Urban.

***Sylepta silicalis* (Guenée)**

A rare moth in the Island, widely distributed through tropical America from Mexico to Brazil and the West Indies.

Moth: A yellow moth with very faint markings across the wings, about 22 mm. in wing expanse. (See Plate XIII.)

Caterpillar: Fully grown caterpillar about 30 mm. long, green color with dark brown head.

Habits: The caterpillar was recorded once as a leaf-roller, however the writer found it boring in the buds or feeding on the tender leaves at the terminals on branches of "yagrumo" trees. The moth seems to prefer the middle altitudes, all the records from Puerto Rico indicating such.

Host: Recorded once as a leaf-roller on "yagrumo macho", *Didymopanax morototoni* (Aubl.) Dcne & Pl., at Lares, 1922. Later on, during Sept. 1940, the writer collected the caterpillars feeding in the buds of "yagrumo or yagrumo hembra", *Cecropia peltata* L., at El Yunque Mts. (altitude 1,900 ft.).

***Paradosis flegia* (Cramer)**

Although this insect is not common in the Island, it is one of the most common moths of Central America, also recorded from Mexico, United States (Florida) and the West Indies. (Listed in IB, p. 462 as: *Margaronia flegia* Cramer.)

Moth: The moth is white, with a characteristic subcostal blue line or streak; anal tuft white; wing expanse 33 to 53 mm. The moth can be easily identified by means of the blue line on the fore wings.

Host: The caterpillar feeds on the foliage of "cabalonga", *Thevetia nereifolia* Juss.

***Diaphania costata* (Fabricius)**

(The Rauwolfia Leaf-folder)

Fairly abundant in Puerto Rico, present also in other West Indian islands. (Listed by Möschler, p. 298 as: *Pachyarches aurocostalis* Guenée; IB, p. 462 as: *Margaronia aurocostalis* Guenée.)

Moth: The moth is white, with a light brown abdomen, brown anal tuft and a characteristic golden subcostal line or streak on the fore wings. Wing expanse 20 to 25 mm. (See Plate XVI.)

Caterpillar: The caterpillar is about 25 mm. when fully developed; green, transparent; head flattened, light brown except for dark brown labrum and black ommatidia. Thoracic shield light brown, legs green.

Pupa: The pupa is brownish in color, about 13 to 15 mm. long.

Habits: The caterpillar, which is a leaf-folder, feeds on the epidermis

of the leaves inside the fold, rarely piercing through. When the food supply is exhausted in one of the folds, it moves to another leaf, folds it and starts feeding again. Only a part of the leaf is folded, usually along the edge. Some leaves show two or three folds at the same time. The larva pupates in one of these folds. Before so doing it turns yellowish and then pink or reddish and the pupation takes place within a day or two. *Diaphania costata* is a typical lowland insect, very abundant especially in the dry districts of Puerto Rico where its host tree is commonly found.

Host: The caterpillar feeds on the foliage of "palo amargo", *Rauwolfia nitida* Jacq.

Agathodes designalis Guenée

(The Bucare Caterpillar)

A very common moth in Puerto Rico, also recorded from Florida and tropical America (Mexico, Guatemala, Costa Rica, Colombia, Ecuador, Brazil and Hispaniola.) (Listed by Möschler, p. 303 as: *Stenurges designalis* Guenée and also recorded by him as far south as Argentine in the South American continent.)

Moth: In a few words, the moth can be described as follows: hind wings pale semi-transparent, tinted with golden, fore wings having a peculiar colored pattern, in which tints of reddish are predominant. Wing expanse 27 to 32 mm.

This species which was described by Hulst (1886) p. 156, as *Stenurges floridalis* Hulst, is now in synonymy with *A. designalis* Guenée. Hulst's description is as follows:

"Expands 31 mm. Palpi dirty whitish; head same color in front; white between the antennae and along eyes in front; thorax white; patagiae dirty yellow. Abdomen, first segment white, the next reddish brown above, edged behind with white, then olive-brown, slightly annulated with dark brown at segments; blackish anteriorly on side; fore wings with costa narrowly white; a broad mixed pink and brown-red band starts from inner margin at middle and runs straight to costa, striking it two-thirds distance out from base, and there meets and merges with a smaller band from centre of outer margin; these lines are edged with a fine metallic silver line; field within the line basally, and apical space dirty olive; space at outer angle ferruginous; at base in olive space is a dark fuscous dash; gringe wine red towards apex, whitish posteriorly; marginal white line, fine; outer border not angulated; hind wings pale fuscous, with an ochreous reddish tinge; beneath, pale dirty fuscous; legs pure white." (See Plate XVII, also color illustration in Holland 1913, Plate XLVIII, fig. 3.)

Caterpillar: The larva is about 22 mm. long when fully grown, about 3 mm. in diameter in the widest part of the body about its middle, then

tapering towards the anterior and posterior ends. Head capsule light brownish orange, about 2 mm. in width when caterpillar is fully grown; mouth parts dark brown. General ground color of the larva is light green, dorsally two whitish or very light green lines or bands, separated about 2 mm. run all the way from the first thoracic segment to last anal segment of body. Segments 4 to 11, each of them bear dorsally, 4 black or black and green tubercules, arranged in a square, between the two whitish dorsal lines, the anterior pair larger than the posterior ones on the same segment; each tubercule bearing a silvery setae. Each tubercule is also surrounded by a whitish or light green line. The space between the tubercules in the area within the two whitish lines is darker green than the rest of the body. Thoracic legs dark brown, prolegs light green.

Pupa: The pupa is about 18 to 20 mm. long and light brown in color. Pupation period 10 days.

Habits: Newly hatched caterpillars are about 2 mm. long, and of a transparent green color. There is no color differentiation at first between the body and head capsule. For the first four or five days the young caterpillar feeds only on the upper epidermis of the leaves. It grows very fast and by the end of 8 or 10 days a single caterpillar can eat two whole leaves of *Erythrina* in a single day. On its eighth day the larva is nearly full grown. Many larvae reared, pupated on their tenth day.

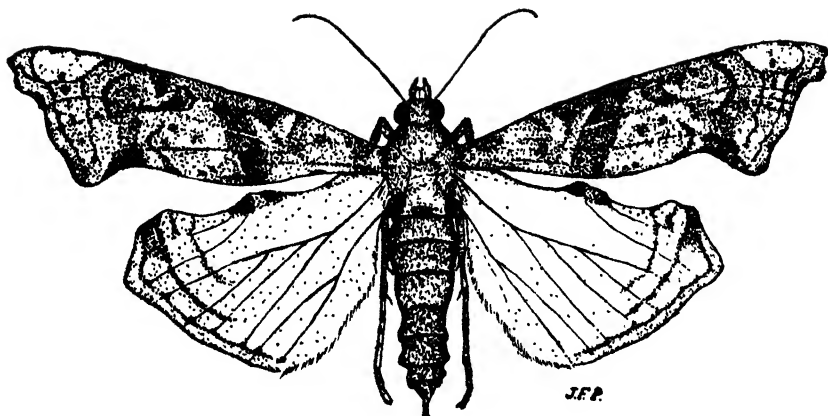
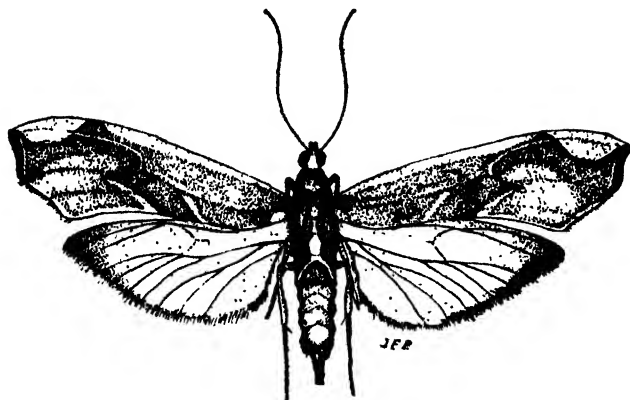
The habits of the larva are very peculiar. At first, when they are very young, they start by doing a sort of little silken shelters, where they stay when not feeding. As they grow they begin to fold an edge of the leaf and then they are concealed beneath this fold; often two or three leaves are glued together and live among them, feeding constantly at the same time. Pupation takes place in the leaves, either in the fold previously made or between two or three leaves. The caterpillar spins a very fine silken cocoon around its body just before pupation.

The caterpillar is a leaf-roller or leaf-folder and at the same time a twig-borer. When acting as twig-borer the ground color of the body instead of being green is creamy or cream reddish. In this case pupation takes place in the bore in the twig.

This species is very voracious and pestiferous, doing damage of considerable importance, not only by causing heavy defoliations but by destroying the new shoots as these develop year after year. The insect ranges from the low altitudes to the middle and higher in Puerto Rico. In Costa

PLATE XVII

Agathodes designalis Guenée
Terastia meticulosalis Guenée



Rica (Central America) specimens have been collected at Volcán de Irazu at 6,000 to 7,000 ft. in altitude.

Natural Enemies: The only parasite recorded in the Island attacking this insect is *Lissonota* sp., a parasitic ichneumonid which attacks the caterpillar.

Host: Möschler recorded the insect from *Erythrina crista-galli* L., from Argentine. This tree species is occasionally planted in the Island but the insect has not been recorded so far from it. In general *Agathodes* should be called a pest of *Erythrina*. Locally it has been recorded from the following species:

Erythrina berteriana Urban "machete"

Erythrina glauca Willd. "bucare"

Erythrina poeppigiana (Walp.) O. F. Cook "bucare"

The caterpillar has been also recorded as boring in the trunks of *E. glauca* Willd. and *Inga vera* Willd., our common "guaba".

***Terastia meticulosalis* Guenée**

(The Bucare Twig-borer)

A fairly common species in Puerto Rico, although not so abundant as *Agathodes signalis* Guenée. Also recorded from Florida, tropical America (Mexico, Guatemala, Honduras, Costa Rica, and in the Antilles: Hispaniola and Puerto Rico) and the East Indies.

Moth: In general, the moth can be described as light brown in color, with very prominent dark brown markings in the fore wings; hind wings shining semi-hyaline. The peculiar shape of the fore wings is very characteristic of the species. Wing expanse 35 to 42 mm. (See Plate XVII.)

However, Hulst (1886, p. 156) described this species from Florida as *Megastes coeligenalis* Hulst, as follows:

"Expands 40 mm. Palpi and front dull ochreous; vertex yellow, white between the antennae and eyes; thorax and abdomen fuscous, lighter dorsally; fore wings fuscous hyaline; costa and base fuscous, the costa, within edge, black, especially near middle of wing; a fuscous olive broad inter-medial band oblique; orbicular and reniform prominent, annulate; space beyond band thinly fuscous, almost hyaline; a narrow shading running from orbicular to anal angle and a costal apical line soon returning beyond itself to costa near apex; outer margin somewhat falcate, sinous, angulate at middle of anterior margin; this angle and the outer angle dark brown; two faint submarginal cloudings near apex; margin blackish; beneath, semihyaline; orbicular and reniform distinct; two outer dark lines on fore wings, and apically on hind wings; markings brown; legs cinerous fuscous." (Color illustration in Biol. Centr.-Amer. Lep. Het. vol. 3, Plate 61, fig. 2.)

Caterpillar: The caterpillar is creamy or whitish in color, about the same appearance as that of *Agathodes designalis* Guenée.

Habits: The caterpillar is a twig and pod borer. All the adults reared have been collected from caterpillars boring in twigs and pods of trees. The insect is found at low, middle and higher altitudes.

Host: Recorded from the following: "machete" *Erythrina berteroa* Urban, *Erythrina glauca* Willd. and in "capá blanco", *Petitita domingensis* Jacq.

***Sparagmia gigantalis* Guenée**

A rare species in Puerto Rico (see Plate XIV); also distributed throughout tropical America.

Host: Mr. F. Seín collected the larva on "yagrumo" or "yagrumo macho", *Didymopanax morototoni* (Aubl.) Dcne. & Pl.

***Pyrausta cerata* (Fabricius)**

(The Péndula Leaf-webber)

This insect is very common in Puerto Rico, also recorded from the United States, Mexico, Guatemala, Panamá, Brazil, Venezuela, Honduras, Colombia, Jamaica, Hispaniola and the Virgin Islands. (Listed by Möschler, p. 283 as: *Bolys cedipodalis* Guenée.)

Moth: The moth is yellow, with transverse yellow-brown markings on its wings, long whitish legs and yellow antennae. Wing expanse 30 to 40 mm.

Egg: The eggs which are laid on the leaves are more or less oval in shape, flat, light green, about 60 or more eggs to a mass, and arranged like the eggs of our common sugar cane moth-borer, *Diatraea*: that is, overlapping one over the edge of the other, just like fish scales.

Caterpillar: The fully grown caterpillar is semi-transparent green, 28-30 mm. long, with cadmium yellow head, on which are several small black spots subtending hairs. The first and last segments of the body with numerous small black dots, the other segments marked dorsally with four quite large black spots, irregularly oval, arranged in a square, each spot with a clear space near the center about the base of a hair; laterally a thick irregular black ring about the base of a hair above the spiracles, and below a narrower black ring around two black dots, each the base of hairs; ventrally a very narrow black ring around the black base of a hair and a group of three black-based hairs on each side of most segments. Legs transparent light yellow. (IP, p. 193.)

Cocoon: The cocoon is made out of a brown silk, in three distinct layers, formed in a folded-over leaf. The cocoon itself is very tough and

hard to break. In this way the pupa inside is partially protected from parasites and other enemies.

Pupa: The pupa is brownish in color. Pupal period 10 to 12 days.

Habits: The caterpillar is a leaf-webber and causes tremendous defoliation on trees. When abundant hundreds of trees are defoliated in the areas affected. The insect ranges from the lower to the higher altitudes in Puerto Rico.

The caterpillar feeds on the foliage of the trees, at the same time making large webs. Sometimes four or five caterpillars are found in a single web. Pupation takes place in the webs, the larvae spinning cocoons and pupating in them.

Natural Enemies: The caterpillar is parasitized by the ichneumonid wasp, *Epihiosoma insularis* Viereck.

Host: The caterpillar feeds on the foliage of the following trees:

<i>Citharexylum caudatum</i> L.	"péndula"
<i>Citharexylum fruticosum</i> L.	"péndula"
<i>Vitex divaricata</i> Sw.	"higüerillo"

***Spilomela fimbriauralis* (Guenée)**

(The Colubrina Leaf-roller)

This species is not abundant in Puerto Rico. It has been recorded from Mexico, Central America and South America as far South as Brazil, also the West Indies.

Moth: A beautiful dark or bright yellow moth with body and wings marked with brown and golden spots; the golden spots very plainly visible along the outer margin of the wings. Anal tuft dark brown, wing expanse from 16 to 23 mm. (See Plate XVIII.)

Caterpillar: The fully grown caterpillar is about 15 to 18 mm. long, green, shiny, transparent, head light brown, the sides of the epicranium mottled by dark brown markings, these markings following back and including the thoracic shield. Front, adfrontals, and clypeus very light brown, labrum and mandibles brown, antennae dark brown, ocelli black. Legs green.

Pupa: The pupa at first is brownish green, then turning brown, shiny. Pupation period 9 days.

Habits: The caterpillar is a leaf-roller usually found in shady places, never attacking trees exposed to the open sunlight. All the trees infested in the field were those just below a canopy formed by the branches of higher trees, thus producing ideal shady conditions. In some trees about 50 per cent of the leaves were rolled. Often one finds three or four rolls in a leaf. The caterpillar feeds on the foliage inside the roll. When the

food is exhausted it moves along and builds a new roll. The edges of the nearly perfect roll are kept together by means of fine but strong silken hairs; otherwise it would be impossible to keep the leaf so well rolled. The roll usually follows a pattern; that is, the leaf is rolled from the lower epidermis up, the shiny part of the leaf going towards the inside. Pupation takes place inside the roll, but sometimes the caterpillars when ready to pupate leave the rolls, web two or three leaves together and pupate between them. Before pupation the caterpillar takes a very light green color. A fine silken web or cocoon is spun around the pupa before pupation. Field observations demonstrate that the insect is a lowland type, it never has been collected at middle altitudes.

Host: The caterpillar is a leaf-roller on "abeyuelo", *Colubrina arborescens* (Mill.) Sarg.

***Azochis rufidiscalis* Hampson**

(The Jagüey Twig-Borer)

A fairly common species in Puerto Rico, also recorded from the United States.

Moth: The moth is very light yellow, nearly white, with reddish brown markings on the fore wings and abdomen. Wing expanse about 26 mm. (See Plate XVI.)

Host: The caterpillar of this species is a twig-borer on "jagüey", *Ficus stahlii* Warb.

***Pilocrocis secernalis* (Möschler)**

(The Capá Blanco Leaf-webber)

A species with a limited distribution in Puerto Rico, Jamaica and Hispaniola. (Described by Möschler, p. 288-9 as: *Botys secernalis*; in IB, p. 468, listed as: *Botys secernalis* Möschler.)

Moth: The moth is medium brown in color with transverse dark brown markings on both fore and hind wings. Wing expanse from 18 to 20 mm. (See Plate XVIII.)

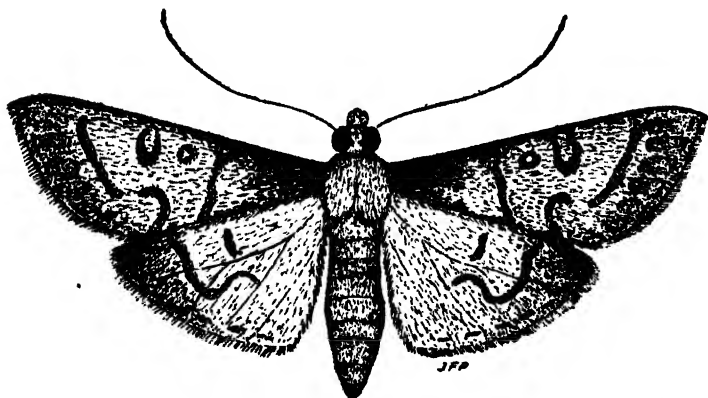
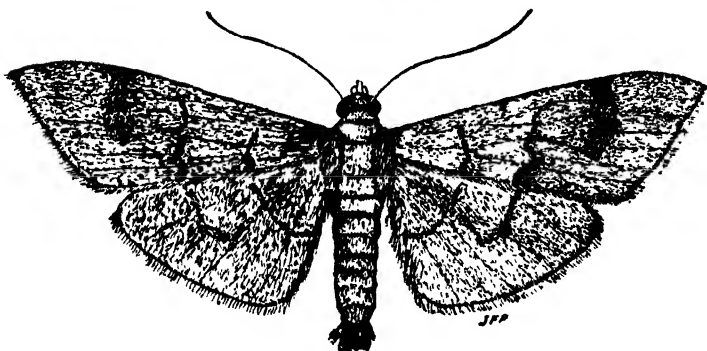
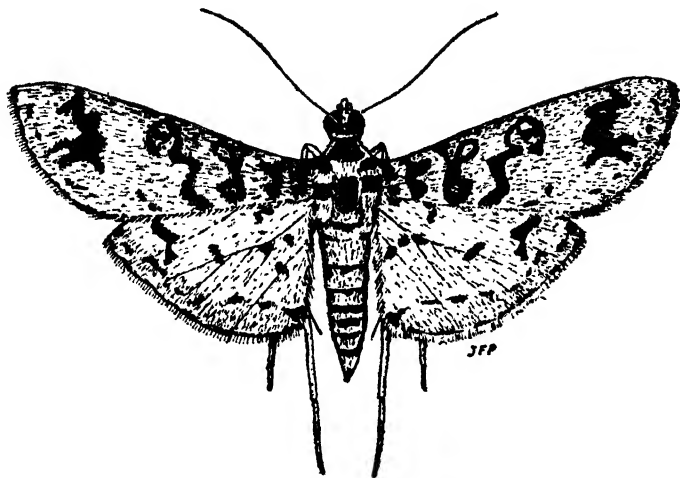
Habits: The caterpillar is a leaf-webber and usually webs three or four leaves together, feeding upon them and pupating in the web also. A very fine silken cocoon is spun by the caterpillar just before pupation. The insect has been collected in altitudes ranging from sea-level to 1000 ft. in elevation.

PLATE XVIII

Spilomela fimbrialis (Guenée)

Phostria martyralis (Lederer)

Pilocrocis secernalis (Möschler)



(Luis F. Martorell: A Survey of the Forest Insects of Puerto Rico)

Natural Enemies: A parasitic wasp of the genus *Microgaster* attacks the caterpillar.

Host: The caterpillar feeds on the foliage of "capá blanco", *Petitita domingensis* Jacq.

***Pilocrocis inguinalis* (Guenée)**

(The Higüerillo Leaf-Roller)

A species which is not common in the Island, apparently adapted to middle and higher elevations.

Moth: The moth is yellow, with brown markings in fore and hind wings, yellowish antennae and white legs. Wing expanse 18 to 22 mm.

Natural Enemies: The caterpillar is parasitized by the larvaevorid fly, *Argyrophylax albicincta* (Wiedemann) and by a braconid wasp, *Microgaster* sp. Both were reared from caterpillars collected at El Peñón del Collao, near Cayey, at 2,000 ft. in altitude.

Host: The caterpillar feeds on the foliage of *Vitex divaricata* Sw., commonly known as "higüerillo".

***Pantographa limata* Grote & Robinson**

(The Guano Leaf-Roller)

This species is not abundant in Puerto Rico. The insect is widely distributed and ranges from Maine throughout the eastern States, to Mexico, Central and South America as far as Patagonia.

Moth: The moth is yellow with brown markings on both wings; legs and antennae white; wing expanse 36 to 38 mm. (See Plate XV.) (Color illustration in Holland 1913, Plate XLVII, fig. 38.)

Caterpillar: The fully grown caterpillar is 30 mm. long, dark green with dark brown head. The spiracles are very prominent, light brown. Larva shows very few setae on body.

Pupa: The pupa is dark brown, smooth, shiny, 18 to 20 mm. long. Pupation period 10 to 12 days.

Habits: The caterpillar is a leaf-roller. The young larva does very small rolls but as it grows the size of the roll is increased and sometimes these are about four or five inches in length. About 6 or 7 rolls have been noticed on a single leaf. The larva feeds on the foliage inside the roll and when the food is exhausted it moves and makes a new roll and so on, until ready to pupate. Pupation occurs in the rolls. The insect ranges from lower altitudes to middle altitudes from 600 to 1,800 ft.

Natural Enemies: On opening several rolls sometimes one finds only the head capsule, the body of the caterpillar being completely destroyed by a parasite. Instead, white silken cocoons, about 8 mm. long are found

near the head capsule. Parasites reared proved to be the braconid wasp, *Chelonus insularis* Cresson. These were very abundant and presumably played a good role in the control of this insect.

Host: The caterpillar is a leaf-roller in "guano", *Ochroma lagopus* Sw.

***Syllepsis marialis* Poey**

(The Thouinia Leaf-Roller)

A species which is not common in Puerto Rico, is also recorded from Cuba, Jamiaca, Costa Rica, Panamá, Colombia and Brazil. (Listed by Möschler, p. 276 as: *Syllepsis marialis* Poey; same name in IB, p. 463.)

Moth: The moth has light yellow fore wings with an elongated brown spot, starting at base and extending out by the costal area towards the middle of the wing, a large brown spot on apex, and a small brown spot on inner angle; hind wings light yellow, semi-transparent, with a brown spot on outer angle, this smaller than the one on the apex of fore wings. The spots on wings as well as the yellow area are iridescent, giving to the spots a somewhat bluish brown appearance. Head, thorax and abdomen dorsally brown, ventrally whitish except for the last segments of abdomen which are light brown. Legs white. Wing expanse 20-22 mm.

Caterpillar: Quite small caterpillar of a shiny green color.

Habits: The larva is a leaf-roller, doing small rolls on the foliage of host trees and later pupating in them. The only shrubs infested were those under the shade of trees. Trees examined in the open were free from infestation. Presumably this species exhibits the same habits of the Colubrina leaf-roller, that is, showing a marked preference for shady places where to live.

Host: The caterpillar feeds on the leaves of "serrezuela", *Thouinia portoricensis* Radlk.

FAMILY EPIPASCHIDÆ

***Jocara majuscula* (Herrich-Schaffer)**

(The Laurel Leaf-Webber)

A moth which is rare in Puerto Rico; also recorded from Cuba. (Described by Möschler, p. 279 as: *Deuterollyta infectalis* Möschler: in synonymy.)

Host: The caterpillar gregarious in habits, is a leaf-webber and feeds on the foliage of the following trees:

Nectandra membranacea (Sw.) Griseb.

"laurelillo"

Nectandra sintenisii Mez

"laurel amarillo"

Ocotea leucoxylon (Sw.) Mez

"laurel geo"

Phoebe elongata (Vahl) Nees

"laurel bobo"

FAMILY CHRYSAUGIDÆ

Pachymorphus subductellus Möschler

(The Roble Twig-Borer)

This twig-borer is very common in Puerto Rico and affects the trees of the genus *Tabebuia*. It occurs from the lower to the higher altitudes, up to 3,000 ft. The following trees have been recorded as being attacked by this borer:

<i>Tabebuia argentea</i> (Bur. & Schum.) Britton	"roble de plata"
<i>Tabebuia haemantha</i> (Bert.) DC.	"roble colorado"
<i>Tabebuia heterophylla</i> (DC.) Britton	"roble prieto"
<i>Tabebuia lucida</i> Britton	"roble de mona"
<i>Tabebuia pallida</i> Miers	"roble"
<i>Tabebuia rigida</i> Urban	"roble de sierra"

FAMILY PHYCITIDÆ

Hypsipyla grandella (Zeller)

(The Cedar Shoot-Borer)

A very common insect in Puerto Rico, also recorded from Guatemala, Costa Rica, Panamá, Perú, Brazil, Venezuela and Trinidad.

Moth: The fore wings of the moth are brown or grayish brown with a darker pattern, the hind wings white with a dark narrow margin. The size is variable and the wing expanse ranges from 23 to 42 mm.

Egg: The egg is .90 mm. long and .75 mm. wide, more or less oval in shape in a horizontal section. When freshly laid it is white, translucent, changing to pink when ready to hatch. Just before hatching the color changes to nearly red. The young caterpillar can be easily observed through the transparent chorion, just before hatching. The chorion is very finely reticulated.

Caterpillar: The fully grown caterpillar is about 20 mm. long, whitish or creamy, with many brown tubercles or spots on the body segments, giving a somewhat spotted appearance; head brown.

Pupa: The brown pupa is about 10-12 mm. long.

Habits: The moth lays the eggs in the twigs, especially the tender ones, where the caterpillar on emerging can immediately bore in. Usually these are laid near the buds or in the intersection where the twigs divide, in this way the caterpillar works its way in, just at the intersection of the two twigs. Eggs are laid singly. The caterpillar is a twig-borer and causes tremendous damage. The heaviest infestations are during the Spring when new shoots are developed. Every year these new shoots are de-

stroyed and so on year after year. Finally the trees are killed, very few surviving. The damage is done principally to young trees. The writer has never observed injury in old trees, at least sufficiently noticeable to be alarming, as happens in two or three-year old seedlings. Complete plantations of cedars have been destroyed in Puerto Rico by this borer.

Natural Enemies: Only one parasitic wasp has been so far recorded as attacking the caterpillar. It is an ichneumonid, belonging to the genus *Calliephialtes*. The parasite attacks the caterpillar while it is in the bore inside the twig and feeds on it, destroying it completely in 10 or 12 days. After the caterpillar is eaten the parasitic larva pupates. Pupation period 10 to 11 days. A beautiful wasp emerges from the pupa which can be described as follows: slender, about 10 mm. in length, the female with an ovipositor nearly as long as the body, head black, thorax light reddish, abdomen dark brown and the legs whitish, spotted with dark brown. Wings hyaline with an iridescent violet and green very noticeable. *Calliephialtes* sp. seems to be a strong and active flier, always moving its wings in an up and down motion, keeping them close to its body during this operation. The abundance and efficiency of this parasite has not been determined yet.

Host: The caterpillar is a shoot borer on the following trees:

<i>Cedrela odorata</i> L.	"cedro español"
<i>Cedrela mexicana</i> Roem.	"cedro"
<i>Swietenia mahagoni</i> Jacq.	"caoba"

FAMILY HYBLAEIDÆ

Hyblaea puera Cramer

(The *Hyblaea* Moth)

A fairly common insect in the Island; also present in the warmer parts of the globe; Florida, West Indies, Mexico, Honduras, Guianas, Brazil, Mauritius, India, Ceylon, Burma, China, Java and South Africa.

Moth: The fore wings of the moth are brown, the hind wings dark reddish brown with orange spots, and orange band or border on the outer margins, the under surface of the wings reddish brown to orange with brown markings. Antennae filiform, brown; eyes brown; body on the ventral side hairy, yellowish; abdomen dorsally dark brown and at the posterior end of each segment a fine yellowish band.

Egg: The egg is yellowish or greenish in color, striated, oblong, with long diameter 0.05 of an inch. It is transparent, and just before hatching the dark head of the young larva is seen inside the egg. After hatching the empty egg-shell is colorless.

Caterpillar: The caterpillar is variable in coloration, just the same way

as the adult. Generally it is described as follows: Dark purple-gray above, olive-green below, with dorsal and lateral white lines, a subdorsal series of minute white dots and rings, a series of black dots on lateral line; head and first somite black. The body is covered with a few short hairs or setae. The full grown larva measures about 30 mm. long.

Pupa: The pupa is stout, dark brown to very dark purplish brown, with a few scattered bristles, shiny, about 17 mm. long and 6 mm. in diameter. The young pupa is light brown, its color turning darker with age. Pupation period 10 days.

Habits: The eggs are laid singly on the undersides of tender leaves, generally in an angle between two veins, or where the lateral veins join the midrib. In this way the young larvae will have enough tender tissue to feed upon as soon as they emerge from the eggs.

The caterpillar usually feeds at night, during the day it is hidden in a sort of shelter, made by folding an edge of a leaf and sticking its borders to the rest of the leaf surface. Sometimes they web leaves together, this is especially noticeable when infestations occur in nurseries. The caterpillar is very voracious and can consume large quantities of leaves in a single day. When it is ready to pupate, it will do so in many different ways: (1) by pupating among the leaves of the host tree, already webbed, (2) on the leaves of nearby shrubs or plants, (3) among dead leaves on the ground, (4) and in the soil. The total life cycle for this species is about a month.

Applied Control: Infestations of this caterpillar have been checked by means of arsenate of lead sprayed at the rate of 2.5 pounds per 50 gallons of water. (Martorell, Oct. 1939, p. 25.)

Host: This insect is a pest of teak, *Tectona grandis* L., in India and Burma. R. S. Hole (1904) published an interesting work on the life history of this insect, from which most of the notes on habits, description of caterpillar and egg were taken.

In Puerto Rico, the insect has been recorded as attacking the foliage of the following trees:

Petitia domingensis Jacq.

Spathodea campanulata Beauv.

Tabebuia pallida Miers

"capá blanco"

"tulipán africano"

"roble"

FAMILY COSSIDÆ

Psychonoctua personalis Grote

(The Mangle Stem-Borer)

A common species in Puerto Rico, ranging from the lowlands to the middle altitudes; also recorded from Cuba.

Moth: Fore wings gray, with a black spot at end of cell, hind wings light gray with a tint of brown or orange, body grayish. The size of individuals vary considerably and the wing expanse ranges from 22 to 48 mm. (Illustration in Forbes, 1930, Plate I, fig. 7.)

The insect was described by Grote (1865, p. 251.) as follows:

"Whitish cinereous. Ornamentation sub-obsolete. In the male some obscure marblings of brownish scales along internal margin and terminally. Secondaries whitish, without markings. In the female specimen there is a terminal line and a series of sub-terminal, dark, interspaceal, short dashes. Secondaries with a broad, diffuse, pale blackish band along external margin. Head, thorax and abdomen, whitish cinereous, clothed with long whitish hair which is shorter, however, than in the male."

Caterpillar: The caterpillar, which varies very much in size, is fairly large, white or creamy with a dark yellow or light brown head. (Illustrated in EEWI, p. 315 and IB, p. 484.)

Habits: The caterpillar, which bores in the main trunk and branches of coffee trees in Puerto Rico, also attacks forest trees. The presence of this borer is easily detectable in old wood by a characteristic knotty formation, but on younger branches there is no external indication of infestation until the branches are broken by storms, or when the crop is being picked. The caterpillar, which ranges from the lowlands to the middle elevations, seems to be more abundant in the "mangle" swamps of Puerto Rico. Undoubtedly, originally the host trees of this borer are the species growing in the mangrove swamps of the Island, later on going to "pomarrosa" and "coffee", after this two species were introduced into the Island. (See EEWI, p. 315, for economic notes on this pest.)

Host: The caterpillar bores in the following trees:

<i>Eugenia jambos</i> L.	"pomarrosa"
<i>Laguncularia racemosa</i> (L.) Gaertn.	"mangle bobo"
<i>Rhizophora mangle</i> L.	"mangle colorado"

FAMILY HYPONOMEUTIDÆ

Hyponomeuta triangularis Möschler

A fairly common moth in Puerto Rico, also recorded from St. Thomas and Bermuda. (Listed in IB, p. 484 as: *Yponmeuta triangularis* Möschler.)

Moth: The moth is light gray with numerous black dots, forming four longitudinal series on the fore wings. Hind wing brown-gray, with fringe at anal angle white. Wing expanse 18 mm. (Forbes 1930, p. 100.)

Caterpillar: The fully grown caterpillar is 14 mm. long, with an orange

head. Body canary-yellow, an irregular mediodorsal black spot on each abdominal segment, laterally bordered with white, lateral or which is a much larger irregular black, gray-bordered spot. On the second and third thoracic segments, these large lateral spots are broken in two by median white bands; on the first segment are two black crescents only. True legs black, spiracles black, lateral hairs with black areas at base, prolegs black and white banded.

Habits: The caterpillars are leaf-webbers and build considerable large nests or webs out of the leaves of the host trees. They are gregarious in habits.

Host: The caterpillar feeds on the foliage of "coscorrón", *Elaeodendrum xylocarpum* (Vent.) DC.

***Pectinophora gossypiella* (Saunders)**

(The Pink Bollworm)

This is an insect of great economic importance, for it is the worst pest of cotton in our Island, and also in other parts of the Americas. It is widely distributed throughout the cotton growing regions of the world, Africa, Asia, Japan, Ceylon, Strait Settlements, Philippines and Hawaiian Islands, then in the western hemisphere in Mexico, Brazil, Venezuela, and the West Indies. In Puerto Rico it is widely distributed throughout the cotton areas of the Island, also present in Vieques and Mona.

Moth: "Labial palpi reddish brown; second joint with two diffused black bars exteriorly; terminal joint with two well-defined, broad, black annulations, one at base, the other at apical fourth. Antennae brown with narrow black annulations; basal joint with long black pecten. Face and head light reddish brown with some pale iridescent scales. Thorax reddish brown with a sprinkling of black around the collar; patagia somewhat lighter brown, unmottled. Fore wings darker brown with a series of small, ill-defined, black spots along the costal edge from base to apical fourth, where there is a larger dash of light ochereous brown; dorsal edge and apical part of wing suffused with darker, blackish brown; the middle of the wing is irregularly sprinkled with blackish scales and contains on the cell an ill-defined, round, blackish spot, sometimes divided into an upper and lower spot; there is also a smaller spot on the base of the cell; the pattern of the wing is rather vague and there is considerable variation in different specimens; in many there is an ill-defined blackish fascia at apical fourth just before the light costal dash, but in other specimens this fascia is not present and the round dorsal spot is dissolved into several smaller spots. Cilia light ochereous brown, streaked with blackish. Hind wings dark fuscous, somewhat iridescent, lightest towards base; cilia ochereous, ter-

minal and apical parts suffused with dark fuscous; vein 1c with long, ochreous fuscous hairs on the upper side. Abdomen flattened and ochreous above, dark brown laterally with underside suffused with black and with ochreous scaling at the joints. Legs blackish fuscous with narrow ochreous annulations at the joints. The abdomen is very similarly shaped in the male and in the female and it is exceedingly difficult to distinguish the sexes, even in living moths, without dissection or by examination of the frenulum. The male genitalia are remarkably small in proportion to the size of the species; harpes narrow at base, broadening towards tip; tip strongly haired; a cluster of long, heavy, straight spines from inner side, well within the tip; sacculus armed on its edge with a row of stout spines; uncus moderately long, broad at base, tapering to a point, laterally heavily haired; aedoeagus short, stout, with a terminal hook. In the female the ovipositor is weakly chitinized, covered with stiff hairs; genital plate heart-shaped; bursa copulatrix with two opposite, strongly chitinized, hornlike, serrated invaginations. Alar expanse 15 to 20 mm. (illustration in IB, p. 493).

"Egg: Elongate oval, flattened; about 1 mm. long and 0.5 mm. broad; the shell is pearly white, with a finely wrinkled surface. When newly laid, the egg has a slightly greenish tint. At maturity it turns reddish.

"Caterpillar: The full grown larva is 11 to 13 mm. long, cylindrical, white, with dorsal side strongly suffused with pink. Head reddish brown with blackish brown mandibles and the other trophi yellowish. Thoracic shield rather small, dark brown. Tubercles small, but distinct, yellowish brown, surrounded by deeper pink than the prevalent suffusion and bearing rather short, dark-brown setae. Crotches of abdominal feet 15 to 17.

"Pupa: The pupa is 8 to 10 mm. long, rather plump, reddish brown; posterior end pointed and terminating in a short, stout, upwardly turned hooklike cremaster; entire surface finely pubescent; no long setae, spines or hooks, except on last joint; fronto-clypeal suture distinct and curved sharply upward; clypeus, labrum, pupal eyes and mandibles distinctly indicated; antennae diverging at their extreme tip and not reaching to the tips of the wings; metathoracic legs reaching slightly beyond the wings to fifth abdominal segment. Spiracles small, normal. Anal opening large, slitlike, surrounded by strong hooked setae, 5 or 6 on each side; cremaster surrounded with 6 to 8 similar, strong, hooked setae. Genital opening slitlike, single in both sexes. When mature, the pupa becomes much darker; the imago's eyes can be seen prominently under the gena of the pupal skin, and the segmentation of the adult and legs becomes discernible." (Description of moth, egg, caterpillar and pupa, from Busck 1917, p. 350-1.)

Habits: The small eggs are laid by the females usually singly or in small groups on any part of the fruit or seed pod, calyx and even in the flowers.

The egg hatches in from 4 to 12 days after it is laid. The caterpillar bores inside the pods and starts its life cycle in this way. The larva feeds in the interior of the pods destroying the seeds and fibers, in case of cotton. There are four larval instars, and is during the last one when the caterpillar attains the pink color which has caused its popular name of pink bollworm or "la oruga rosada de la cápsula del algodón." The larval stage lasts for about 20 to 30 days at the end of which pupation occurs. Pupa-tion occurs within the seed pods and usually lasts for 10 to 20 days, depending on such factors as temperature, humidity, rain, etc. (For more interesting information about the habits and life history of this moth, see: Busck, 1917.)

Natural Enemies: The following insects are recorded as parasites of the pink bollworm, some of which were recently introduced, others are native: *Chelonus blackburni* Cam., *Exeristes robartor* (Fabricius) and *Microbracon kirkpatricki* Wilk. (all introduced); *Perisierola* n. sp. near *nigrifemur* (Ashmead) and *Calliciphialtes ferrugineus* Cushman (natives). The common fire ant, *Solenopsis geminata* (Fabricius) has been recorded as a predator. (See Fife, 1939.)

Applied control: The best control for this pest is by the use of agricultural practices such as planting during certain seasons of the year, burning the trash left in the fields after the crop is collected (in the case of cotton) and the elimination of alternate hosts.

Host: The caterpillar attacks the pods or seeds of two trees in the Island: "maga", *Montezuma speciosissima* Sessé & Moc. and "Santa María" or "esmajaguilla", *Thespesia populnea* (L.) Soland. The maga is one of our most beautiful wood producing species and the seed pods are easily destroyed by this insect.

FAMILY COSMOPTERYGIDÆ

Homaledra sabaletta (Chambers)

(The Palmetto Leaf-Miner)

A very common moth in Puerto Rico and Vieques, also recorded from Hispaniola and Florida. The insect was originally described from Florida, from specimens collected on saw-palmetto (*Sabal serrulata*) during the Spring of 1879.

Moth: The moth can be described as silvery gray in color, with a tinge of lavender in some individuals. The species shows two black dots in fold and at end of cell. Wing expanse about 15 mm.

The following is Mr. Chamber's description of the species:

"Very pale ochreous yellow, or perhaps rather stramineous. Outer surface of the second joint of the palpi brown. There is a small brown

spot on the fold near the hind margin of the fore wings, and a larger one at the end of the disk nearer to the costal than the dorsal margin. Alar expansion $\frac{5}{8}$ of an inch".

Caterpillar: The caterpillar is more or less about 14 to 16 mm. when fully grown, slender and subcylindrical in form. The ground color is white tinged with yellow, the head and prothoracic shield being a darker yellow and the mandibles brown. Extending longitudinally from prothorax to anus are eight somewhat irregular, reddish brown stripes, at equal distances apart around the whole body. These stripes are more pronounced as the caterpillar grows. The larva is very active and when disturbed or removed from its mine it drops hanging on a silken thread. These brown color stripes on the body change in color to brilliant pink or rose, when the caterpillar is preserved in alcohol or is mounted on a glass slide with Canada balsam. (Illustration in Comstock, J. H., "Introduction to Entomology", (revised edition) p. 630, Ithaca, N. Y. 1933.)

Pupa: The pupa is about 8 mm. long and rather slender. Abdomen reddish, wing pads yellowish brown. In general the pupa is smooth, shining; the wing pads extend to the eighth abdominal segment. (Notes on moth, caterpillar and pupa from Comstock 1880, p. 209-10.)

Habits: The caterpillar is gregarious and feeds on the undersurface of the leaves of several palms in Puerto Rico. It builds a sort of a silken nest covered by its excrement. This nest extends and covers the part of the leaf upon which it is feeding. The caterpillar is always under this protective cover. As soon as the food is exhausted in one place it keeps on moving and building more nests, feeding at the same time. The injury is sometimes insignificant but the appearance of ornamental plants is ruined by the ugly brown patches left after the insect had attacked a leaf. When abundant they completely ruin the fronds of palms. The fully grown caterpillar spins a silken cocoon under this nest and pupates there.

Natural Enemies: Parasitic wasps are responsible for the control of this caterpillar in the field. The following have been recorded: *Brachymeria incerta* (Cresson), *Spilochalcis homaledrae* Wolcott and *Spilochalcis cocois* Wolcott, all belonging to the Family Chalcididae.

Host: The caterpillar feeds on the leaves of the coconut palm, *Cocos nucifera* L., on "palma de sierra" *Euterpe globosa* Gaertn., and on "palma de Borbón", *Livistona chinensis* R. Br.

FAMILY PSYCHIDÆ

Oiketicus kirbyi Guilding

(The Bagworm)

A very common species in Puerto Rico, also recorded from Jamaica (?) and Cuba. (Listed by Möschler, p. 122 as: *Oeceticus kirbyi* Guilding.)

Moth: The female is a maggot-like creature, destituted of wings and legs, and never leaves the case or bag in which she lives. The male has a wing expanse of 30 to 36 mm., the wings are brown with nearly black areas on the cubital cell and around it, on the fore wings. Body covered by a woolly or brownish pubescence.

Caterpillar: The caterpillar is dark brown mottled with creamy or whitish spots all over the body and can be easily recognized because it is our only species of bagworm in the Island.

Habits: Very little is known about the biology of our species, but in general we might say that the bagworms are polyphagous in their habits, feeding voraciously on nearly all species of trees and causing often heavy defoliation. (F. Morton Jones, 1928, gives a very interesting account on his studies about the Bagworms of Texas.)

Host: The bagworm has been recorded as feeding on the following trees:

<i>Cascaria sylvestris</i> Sw.	"cafeillo cimarrón"
<i>Casuarina equisetifolia</i> Forst.	"casuarina"
<i>Ceiba pentandra</i> (L.) Gaertn.	"ceiba"
<i>Chrysophyllum pauciflorum</i> Lam.	"caimito de perro"
<i>Cordia sulcata</i> DC.	"moral"
<i>Cupania americana</i> L.	"guara"
<i>Guazuma ulmifolia</i> Lam.	"guácima"
<i>Montezuma speciosissima</i> Sessé & Moc.	"maga"
<i>Ochroma lagopus</i> Sw.	"guano"
<i>Persea gratissima</i> Gaertn.	"aguacate"
<i>Petitia domingensis</i> Jacq.	"capá blanco"
<i>Pisonia albida</i> (Heimerl.) Britton	"corcho"
<i>Randia aculeata</i> L.	"tintillo"
<i>Tabebuia pallida</i> Miers	"roble"
<i>Tabebuia rigida</i> Urban	"roble de sierra"
<i>Terminalia catappa</i> L.	"almendra"
<i>Thuja orientalis</i> L.	"tuya"

FAMILY MEGALOPYGIDÆ

Megalopyge krugii (Dewitz)

(La Plumilla)

A very common insect in the Island, apparently endemic.

Moth: The moth is gray or light buff, with numerous white lines on and between the veins of the wings, and some white transverse shading on disc. Wing expanse from 25 to 30 mm. (See Plate XIX.)

Caterpillar: The caterpillar or "plumilla" as it is commonly called in the Island, is very easily identified and can not be possibly confused with any other caterpillar in our fauna. The size of the larva ranges between

25 to 30 mm. when fully grown, and it is all covered by means of white hairs and with brittle spines, which cause a burning sensation if allowed to come in contact with the skin. It really looks like a little powder feathered puff.

Cocoon: The cocoon or pupal case is sort of oval, about 16 by 10 mm. and 7 to 8 mm. in height, with a trap door or operculum by which the moth escapes on emerging. It is rather hard and parchment like and is made out of a special substance secreted by the mature caterpillar mixed with hairs and setae. (See Plate XIX.)

Habits: The caterpillar is a leaf-feeder and when abundant it causes defoliations, sometimes of considerable importance. The caterpillar makes its cocoons usually on the branches, but more often on the trunk of host trees, sometimes 200 or 300 of them are commonly found attached to a small trunk.

Natural Enemies: The two most important parasites of this insect are the chalcidid wasps, *Brachymeria incerta* (Cresson) and *Brachymeria robustella* (Wolcott).

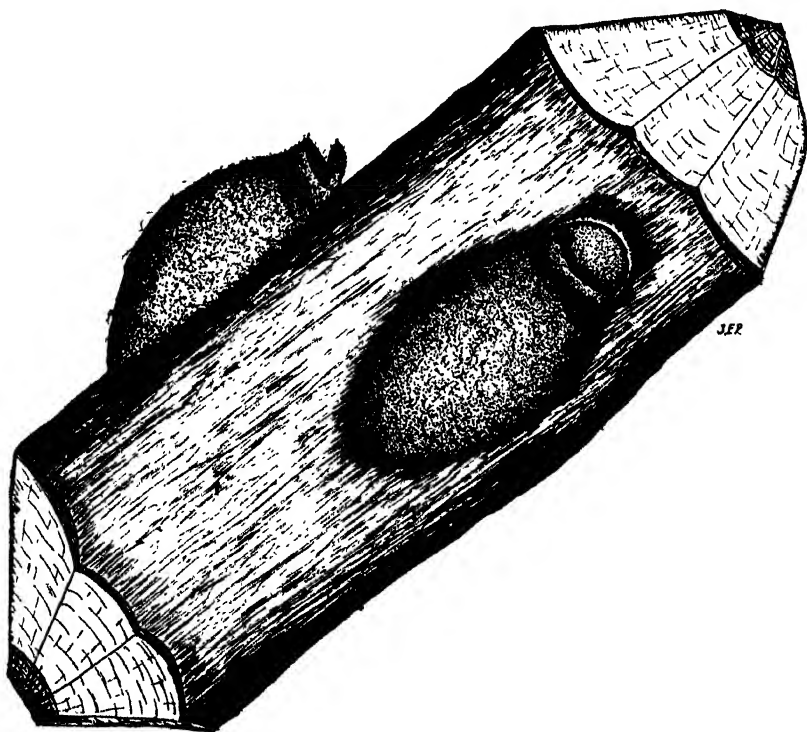
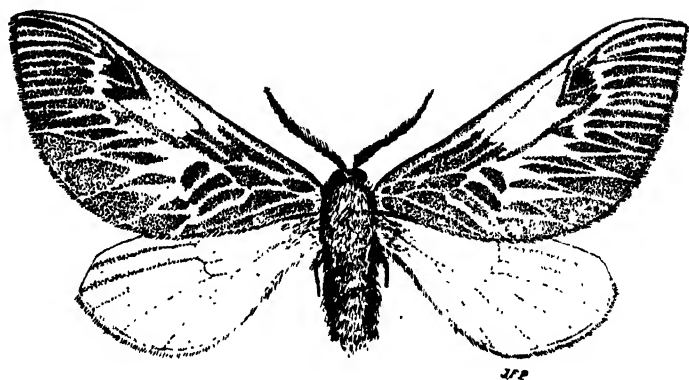
Host: The caterpillar feeds on the foliage of the following trees:

<i>Andira jamaicensis</i> (W. Wright) Urban	"moca"
<i>Brysonima spicata</i> (Cav.) Rich.	"maricao"
<i>Cocos nucifera</i> L.	"coco"
<i>Cordia sulcata</i> DC.	"moral"
<i>Delonix regia</i> (Bojer) Raf.	"flamboyán"
<i>Erythrina glauca</i> Willd.	"bucare"
<i>Ficus laevigata</i> Vahl	"jagüey"
<i>Guaiacum officinale</i> L.	"guayacán"
<i>Guarea trichilioides</i> L.	"guaraguo"
<i>Guazuma ulmifolia</i> Lam.	"guácima"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Nectandra sintenisii</i> Mez	"laurel blanco"
<i>Ormosia krugii</i> Urban	"palo de matos"
<i>Psidium guajava</i> L.	"guayaba"
<i>Rhizophora mangle</i> L.	"mangle"
<i>Sciacassia siamea</i> (Lam.) Britton	"casia amarilla"
<i>Spondias purpurea</i> L.	"ciruela del país"
<i>Terminalia catappa</i> L.	"almendra"
<i>Triplaris caracasana</i> Cham.	"tripilaria"

PLATE XIX

Megalopyge krugii (Dewitz)

Cocoons of *M. krugii* attached to small twig



FAMILY LIMACODIDÆ

Monoleuca albicollis Forbes

This moth was described originally from Puerto Rico and has not been reported from any other part of the West Indies yet. It is a fairly common species, especially at middle and higher elevations, where most of the specimens have been collected.

Moth: The moth was described by Forbes (1930, p. 167) as follows:

"Buff. Head with front white, contrasting, vertex olivaceous; palpi crimson, the terminal segment buff on upper side, not contrasting in color below; antennae (broken) with shaft crimson, at least toward base and pectinations buff. Prothorax white, contrasting, buff on sides. Mesothorax brown shading into crimson; metathorax pale, shading into white at sides. Abdomen without any red tint, but slightly olivaceous. Fore wing buff, the margins and veins crimson; antemedial line diffuse, broad, from middle of costa to fold; post-medial similar, strongly excurved opposite cell, the two lines fusing in fold and below into a large brown patch, which contains a rounded white spot, extended narrowly half way to base on inner margin. Hind wing buff, faintly lined with crimson on veins, with a stronger crimson shade in the fold. Fore wing beneath almost evenly suffused with dull salmon (about the color that would be produced by blending of the buff and crimson of the upper side); inner margin, below Cu, and hind wing pale buff. Fore leg crimson, with fuscous bars on tips of tibia and metatarsus; middle leg pale buff, slightly shaded with crimson, with tibia mostly fuscous, and a bar on metatarsus, the upper side heavily fringed with dense hair. Hind leg pale (damaged). Expanse 13 mm. ($\frac{1}{2}$ inch)".

Cocoon: The beautiful cocoon of this moth is whitish, mottled with brown or vice versa; it is nearly round, sort of oval, about 5 mm. long, 4 mm. wide and 4 mm. in height, with an operculum or lid usually on one end. The moth on emerging escapes through this door or operculum. The cocoons are attached to leaves, sometimes on the undersides and sometimes on the upper surface of the leaves, by means of a glue-like substance secreted by the caterpillar. The cocoon itself is made out of a parchment-like substance, smooth and hard in consistency, at first sight looking like a lizard's or very small bird's egg.

Host: The caterpillar presumably feeds on the foliage of "maricao", *Byrsonima spicata* (Cav.) Rich. and "cedro", *Cedrela mexicana* Roem. All the cocoons have been collected at altitudes ranging from 1,700 to 2,500 ft. Very abundant on the foliage of *B. spicata*. The writer has never been able to observe the caterpillar.

Also attacking the foliage of mahogany, *Swietenia mahagoni* Jacq., at lower elevations.

HYMENOPTERA

Very few, indeed, are the insects belonging to this large group which really cause injuries of economic importance to the trees in Puerto Rico. The Order includes mostly parasitic forms, which otherwise are beneficial and helpful in controlling our most noxious forest, shade and ornamental tree pests.

The most important forms are therefore discussed as fully as possible.

SUPERFAMILY TENTHREDINOIDEA

FAMILY TENTHREDINIDÆ

Sterictiphora Krugii (Cresson)

(The Sea-grape Sawfly)

This interesting sawfly is the only representative of this family present in the Island. It is very common around the coastal plains where most of its host trees grow, but also attacks the foliage of trees at middle and higher altitudes.

Historical: The sawfly was originally described by E. T. Cresson in 1880 as *Schizocera Krugii*, presumably in honor of Herr. F. Krug, who sent the specimens to Mr. Cresson for identification. A year later, Dr. H. Dewitz a German naturalist described the same species as *Schizoceras Zaddachi*, in honor of Prof. Zaddach, Director of the Zoological Museum at Königsberg, Germany. (Dewitz 1881, p. 207-8.) Cresson's description is based on the male of the species, and although no illustrations are given in the description, undoubtedly it is very accurate. Dewitz' description includes both males and females and also illustrations of both sexes, on Plate V, figs. 12 and 12A. The specimens described by Dewitz apparently suffered an intense discoloration by some reason, because he refers to the female, as a yellow insect. In nature the female is bright red. Nevertheless, his description as well as drawings are very accurate and undoubtedly he described the same insect Cresson had already described a year earlier. Later on the species had a generic transfer and was placed in the genus *Sterictiphora*, the specific name *Krugii* having priority over *Zaddachi*.

The species as described by Cresson, is as follows:

Male: "Short, robust, black; head short, very transverse, eyes prominent; antennae slender, flagellum bifurcate, ciliated beneath with blackish pubescence; prothorax, pleura, anterior margin of lobes of mesothorax, coxae and venter reddish-yellow; wings subhyaline, nervures and stigma black, three submarginal cells, the second quadrangular, longer than broad, receiving the second recurrent nervure near the base, under wing with two middle cells; four anterior legs more or less pale in front. Length .23 inch." (Cresson 1880, p. 2.)

The writer had already discussed this insect and its behavior. (Martorell, April 1941, p. 141-4.) The description of the adults, both male and female forms, with their colors as they are seen in the field, follows:

Adults: The female is 8 mm. long, with bright crimson thorax and abdomen; head and mouth parts shiny black; antennae dull, black; legs reddish with dark brown markings; wings transparent with black veins. The male is smaller than the female, about 6 mm. long, the dorsal part of the prothorax, part of the metathorax and dorsal part of the abdomen shiny black. Ventrally thorax and abdomen bright crimson. Head and mouth parts shiny, black; legs rufous. The antennae of the male is plumose, forked, giving the false impression of possessing four antennae. The wings are similar to the ones of the female but much more smaller. (Martorell, April 1941, p. 141.) (See Plate XX.)

Larva: The young larva is dirty green in color when it emerges from the egg. It immediately starts feeding on the foliage, especially on the young, tender leaves, adopting the characteristic posture of the members of this family while feeding. It attaches itself to the edge of the leaf by means of three pairs of thoracic legs, while the abdomen is then curled upwards and a little towards the side.

In the last instars the fully grown larva measures about 25 mm. long, the general color of the body is pink, with a light green line not well defined running dorsally from the first segment to nearly the last one. Dorsally the last abdominal segment is black. The whole body is covered by round, small, black spots regularly arranged. The head is reddish, shiny, with one shiny black line running longitudinally on its center. The region around the ocelli are also black. The legs are strong, fleshy, pinkish and covered with numerous black spots. The uropods and postpedes are pink and small. The larva as described above is the normal stage seen in the field. However, the last larval stage, which is very seldom observed in the field is quite different. Pupation takes place very shortly after this last instar. In it, the head and dorsum are shiny black; the first thoracic segment, the precoxae and the last abdominal segment carmine; the sides of the body wine-colored.

Pupa: The larva spins a tough, parchment-like, brown pupal case, made up of a secretion produced by the larva mixed with leaf particles. The pupal case is nearly oval, with one end truncate, measuring about 10 mm. long by 6 mm. broad. This is attached to the trunk, twigs or branches of a tree. Sometimes hundreds and thousands of these pupal cases are seen in large masses, one very close to the other, often overlapping, on the trunk of large trees. They are usually attached to the side of the trunk or branches where they are less exposed to the direct wind currents or rain. Pupal period about 20 days.

Habits: It has been observed that nearly always the number of females

double that of the males. During oviposition the females stay motionless, not moving even if disturbed while they are laying their eggs. The eggs which are laid on the undersides of the leaves are clustered, the number in each cluster varying from 15 to 40 eggs. Often 6 or 7 clusters are found on a single leaf. After all the eggs are laid, the females remain close to the egg mass, like trying to protect and watch them. The males are gregarious in their habits and often one can see 15 to 20 of them close together on the underside of a leaf, usually in places where the direct wind currents can not hit them. Both males and females are slow moving insects and hand collecting is very easy. At the seashore, the trees nearer to the coast are less infested than those inland or the ones which are back of other trees. The wind disturbs or blows away these small insects.

The larvae are also gregarious, and one often sees a whole row of 10 or 15 larvae close together while feeding on the edge of a leaf.

Applied Control: No natural enemies of the larva or eggs have been recorded so far. However, the larva can be controlled by applications of poison sprays, using powdered arsenate of lead at the rate of 3 pounds to 50 gallons of water, using soap as an adhesive.

Host: The following host trees are attacked by this sawfly:

<i>Chrysobalanus icaco</i> L.	"icaco"
<i>Coccolobis grandifolia</i> Jacq.	"moralón"
<i>Coccolobis laurifolia</i> Jacq.	"uvilla"
<i>Coccolobis pirifolia</i> Desf.	
<i>Coccolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Coccolobis venosa</i> L.	"calambreña"

The writer has never seen the caterpillars nor the adults on *Chrysobalanus icaco* L. The only record on this tree is by Mr. Van Zwaluwenburg.

SUPERFAMILY CHALCIDOIDEA

FAMILY EURYTOMIDÆ

Tanaostigma haematoxyli Dozier

(Campeche Seed Chalcid)

A common insect in Puerto Rico, Haiti and presumably in all of the West Indies and perhaps in continental tropical America, wherever its host tree is found.

PLATE XX

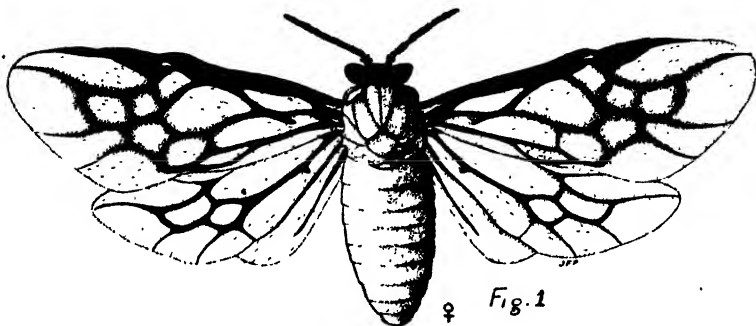
Sterictiphora Krugii (Cresson) (Tenthredinidae)

FIG. 1. Adult female (actual size 8 mm. long)

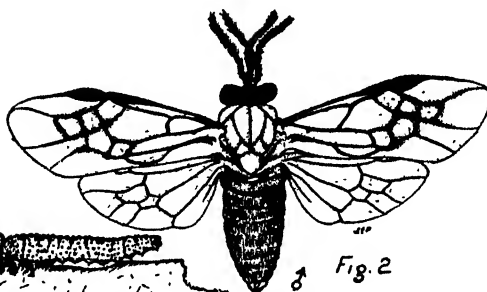
FIG. 2. Adult male (actual size 6 mm. long)

FIG. 3. Larvae 25 mm. long and eggs 2 mm. high

FIG. 4. Pupal cases on branch (actual size 10 mm. x 6 mm.)



♀ Fig. 1



♂ Fig. 2

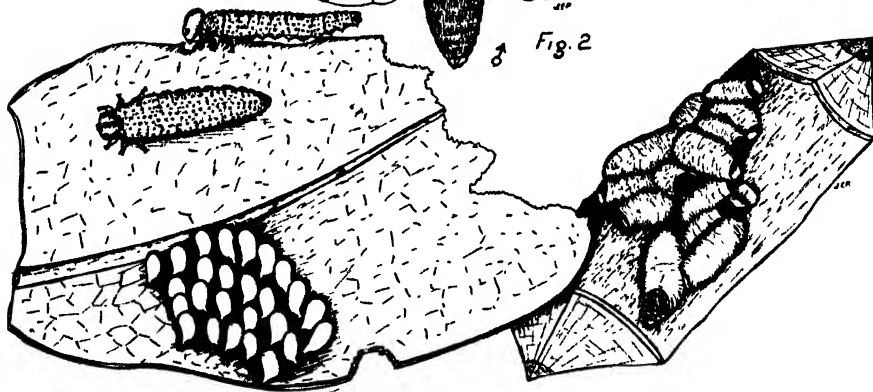


Fig. 3.

Fig. 4

Female: "Length 1.21 to 1.46 mm.; expansion 2.84 mm.; greatest width of forewing 0.573 mm. The general appearance of the female is stout and compact, the thorax decidedly humped or convexly elevated; slightly pubescent with light colored hairs. General color a dark honey-yellow, the vertex and more dorsal portions of the thorax and abdomen more or less infuscated giving a fuscous appearance except along the sides; the sides of the abdomen are pale in color. Antennae dark brown except the pale ring-joint and the white club; 11-jointed; club apparently solid; pedicel nearly twice as long as wide, followed by a small ring-joint and a second larger and darker joint that borders on being a true ring-joint, decidedly smaller and narrower than the funicle joints which are sub-equal in length and only slightly widening to the club. Head transverse. Pronotum narrower than the head and slightly longer, the scutellum convexly elevated, with reticulate markings or areas on surface. Forewings hyaline, venation pale brown, the stigmal vein very thick, covered with numerous curved setae. Under high magnification, specimens mounted in balsam, show the thorax and abdomen to be distinctly reticulated. Legs brown, the hind tibiae armed with pale rigid bristles along the inner margin" (See fig. 17, a.)

Male: "Length 0.86-1.37 mm.; expansion 2.65 mm.; greatest width of forewing 0.502 mm. Easily distinguished from the female by its smaller size, narrower and more slender build, lighter coloration, and immediately by its branched antennae. General color similar somewhat to that of the female but lighter yellowish. Antennae 13-jointed, composed of a rather broad scape, short stout pedicel, a pair of minute ring-joints, the next five funicle joints increasing in length, each one with a lateral prolongation, successively shorter, giving a branched appearance; the last funicle joint is slightly shorter than the two preceeding and has only a suggestion of a short lateral prolongation." (Description of female and male, from Dozier 1932, p. 105.)

Larva: The larva is pale creamy white in color and about 1.75 mm. long. (See fig. 17, b.)

Pupa: The pupa is creamy in color at first, but as it develops the eyes become distinctly reddish, and the mandibles take a reddish, chitinized appearance. Before emergence the pupa becomes much darkened. (See fig. 17, c.)

Habits: The habits of this insect were studied by Dozier and from his publication the following is cited:

"The adult wasps soon after issuing were observed to start mating, actively running over the seed pods. The eggs are extremely small and are deposited within the young tender pods by means of the ovipositor. The oviposition scars are readily visible from the outside and each seed

is occupied by a larva. The consequent reaction produces a gall-like deformation of the seeds and with it the pod is definitely thickened along the middle.

"The result is that in many cases every seed in the entire cluster of pods is completely destroyed. In this way the logwood is prevented from re-

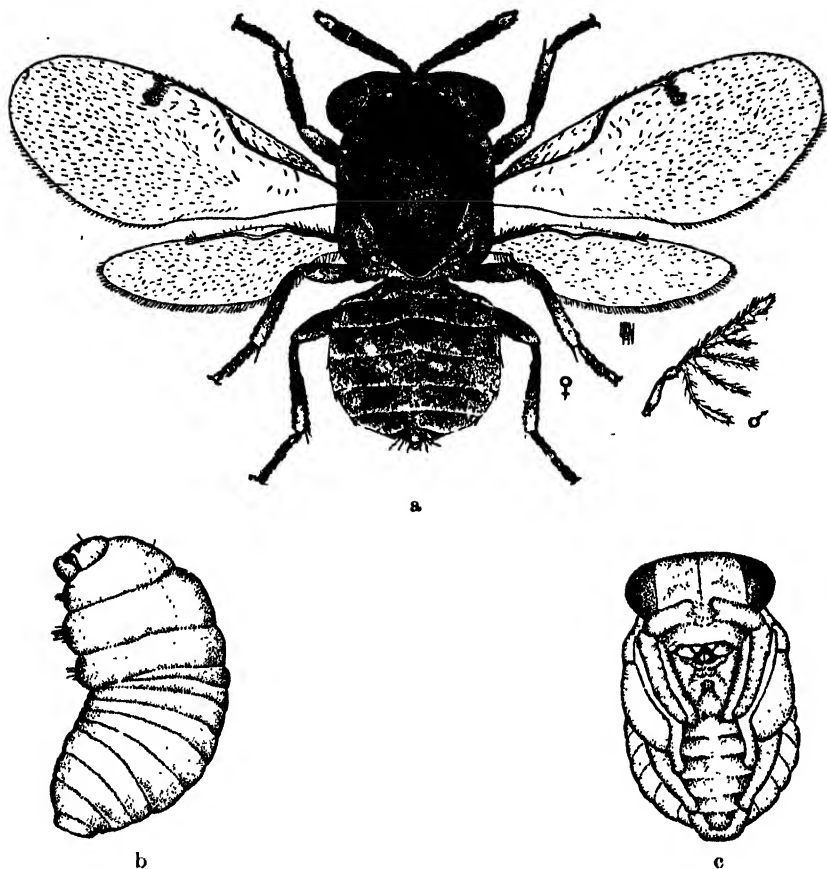


FIG. 17. *Tanaostigma haematophyli* Dozier: (a) female, about 50X. (b) fully grown larva (c) pupa (d) antenna of male (Drawn by L. Pierre-Noel.)

seeding itself. Observations made over the two-year period show that this is serious. Fortunately, however, the logwood is so prolific that it is probably capable of producing enough seedlings to replace itself if freed, even if at long intervals, from the attack of this wasp by unusual activity and restraint on the part of its parasite."

Natural Enemies: None reported so far from Puerto Rico. Dr. Dozier

found two parasitic wasps, *Eupelmus* sp. and *Horismenus* sp., parasitizing the chalcid, in Haiti.

Host: The insect attacks the seeds of "campeche" *Haematoxylon campechianum* L.

***Bephrata cubensis* Ashmead**

(The *Annona* Seed Chalcid)

A common species in Puerto Rico, also recorded from Cuba (from which it was originally described), Jamaica, Hispaniola and Florida. The writer found in Venezuela, a species closely related to this one, *B. maculicollis* Cam. infesting the seeds of *Annona muricata* L., at Caracas and La Providencia, near Maracay. (Martorell, Oct. 1939, p. 228.)

The insect was described from 3 specimens collected in Cuba. Original description:

"Female: Length 8 mm. Rufous, coarsely, umbilicately punctate; scape, except apex above, legs and tegulae, pale ferrugineous; flagellum brown; wings hyaline, with a dusky blotch on the disc below the marginal nervure, the latter being a little longer than the stigmal; the stigmal ending in a small knob, not longer than the post-marginal. First flagellar joint about as long as the scape, but stouter, the following joints longer than thick; frons with a deep antennal furrow. Abdomen longer than the head and thorax united, compressed, roundly elevated dorsally towards base, then depressed and curving upwards at tip, the ovipositor slightly projecting; petiole very short, wider than long; sides of abdomen with white hairs." (Ashmead 1894, p. 321-2.) (See fig. 18.) (See also Dozier 1932, pp. 109-12.)

Habits: The female wasps lay their eggs in the young developing fruit and when the larvae develop, they are already inside the seeds, upon which they feed and completely destroy. The insect leaves the fruits as an adult, by gnawing exit holes, which are plainly visible by the naked eye on the attacked fruits.

Host: In the Island the insect has been recorded from the seeds of:

Annona muricata L.

"guanábana"

Annona reticulata L.

"corazón"

SUPERFAMILY FORMICOIDEA

FAMILY FORMICIDÆ

***Myrmelachista ramulorum* Wheeler**

(La Hormiguilla)

One of the most serious pests of coffee in Puerto Rico is this species of ant, popularly known as the "hormiguilla". It also affects the shade trees

in coffee plantations as well as many other trees on the Island. The insect is found in the lowlands as well as middle and higher altitudes.

Ant: The ant is small, with a reddish yellow thorax, blue-black head and abdomen, yellowish appendages and 8-segmented antennae (worker).

Habits: These insects do their damage by tunneling in the branches and trunks of trees, by girdling or causing large and unsightly galls. Inside these tunnels the ants harbor and take care of a species of coccid, *Cryptostigma inquilina* (Newstead), from which they obtain honeydew. They also obtain more of this substance by taking care of other insects,

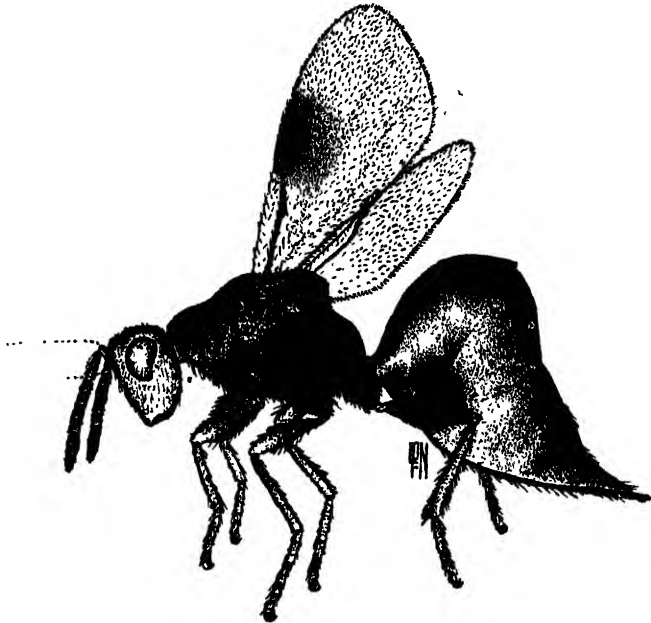


FIG. 18. *Bephrata cubensis* Ashmead, female. About one hundred times natural size. (Drawn by L. Pierre-Noel.)

such as the scale insects, *Coccus viridis* (Green), *Saissetia hemisphaerica* (Targioni), the mealybugs, *Pseudococcus nipae* (Maskell) and *P. citri* (Risso) and the aphid or plant louse, *Toxoptera aurantii* (Fonscolombe). The "hormiguilla" forms numerous colonies in the trees, and scarcely a tree is found in coffee plantations which the ants do not nest in. Smith, in studying this species, estimated that on a moderate sized "guaba" tree there were 37,100 workers, 89 fertile or mother queens, and 60 winged males, or an average of 415 workers per queen. (Smith 1936, p. 873.)

Applied Control: The artificial control of this insect in coffee planta-

tions is a problem by itself. Up to date all the methods tried have not been successful at all. Meat or fish baits mixed with thallium nitrate and acetate have been used, fish oil has also been employed as a repellent. "Continued experiments show no improvement in poison bait itself is needed, but in method of application, as water-soluble thallium compounds are very toxic to coffee shade trees." (Wolcott, IP, p. 150.)

For more information on the control of this species the reader may refer to the works of G. N. Wolcott. (See also EEWI, pp. 317-321.)

Host: The insect has been recorded from the following trees in the Island:

<i>Bucida buceras</i> L.	"úcar"
<i>Coccolobis uvifera</i> (L.) Jacq.	"uva de playa"
<i>Erythrina berteroaana</i> Urban	"machete"
<i>Erythrina poeppigiana</i> (Walp.) O. F. Cook	"bucare"
<i>Ficus lacrigata</i> Vahl	"jagüey"
<i>Inga vera</i> Willd.	"guaba"
<i>Inga laurina</i> (Sw.) Willd.	"guamá"
<i>Eugenia jambos</i> L.	"pomarroza"
<i>Mangifera indica</i> L.	"mangó"
<i>Spathodea campanulata</i> Beauv.	"tulipán africano"
<i>Spondias purpurea</i> L.	"jobillo"
<i>Triplaris caracasana</i> Cham.	"triplaria"

Camponotus ustus Forel

A very common species in Puerto Rico, also present in Haiti and the Virgin Islands. This is probably one of our largest ants, very conspicuous and easily recognizable. However, it could be confused with its closely related form *C. sexguttatus* (Fabricius). The following characters will serve to differentiate the two species from others as well as to distinguish between *ustus* and *sexguttatus*. Both species have more than 9 segments in the antennae, the workers are polymorphic instead of monomorphic. Then the two species are differentiated one from the other by the following characteristics:

Head of major worker light red anteriorly; with pale spots often on first and third as well the second gastric segment; minor workers usually with spots only on the second segment. Head, thorax, and gaster of both major and minor workers dark brown, smooth and shining . . . *sexguttatus* (Fabricius)

Color light yellowish brown, with the head and segments of the gaster often infuscated . . . *ustus* Forel (Key from Smith 1936, p. 866.)

Habits: The insect is found abundantly in burrow in the branches and

twigs of trees. Whether they actually do their own boring or just nest in old abandoned bores has not been yet determined. (See Plate XXI.)

Host: The species has been recorded from the following trees:

<i>Coccolobis wifera</i> (L.) Jacq.	"uva de playa"
<i>Colubrina arborescens</i> (Mill.) Sarg.	"abeyuelo"
<i>Inga vera</i> Willd.	"guaba"
<i>Sideroxylon foetidissimum</i> Jacq.	"tortugo amarillo"
<i>Tetrazygia clacagnoides</i> (Sw.) DC.	"cenizo"
<i>Zanthoxylum caribaeum</i> Lam.	"espino rubial"

SUPERFAMILY APOIDEA

FAMILY XYLOCOPIDÆ

Xylocopa brasilianorum (Linnaeus)

(El Cigarrón)

This insect is the largest member of the Apoidea in the Island. The "cigarrón" is very abundant and well known in Puerto Rico, particularly the female of the species, which is seen frequently hovering around flower blossoms in fields and gardens.

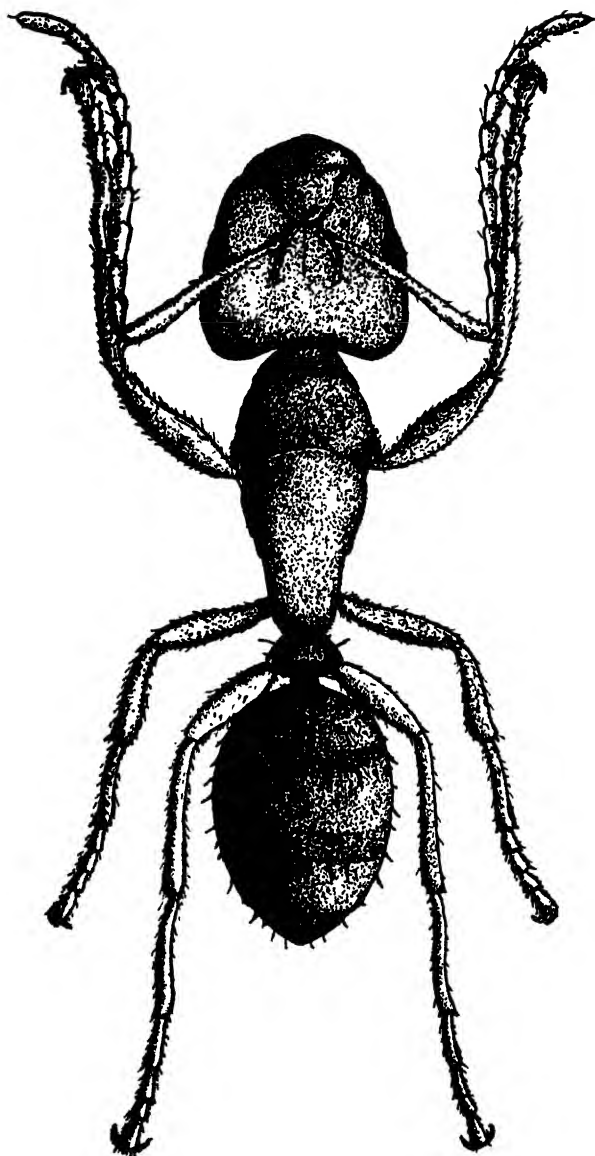
Mr. A. J. Ackerman, redescribed the species in his revision of the carpenter—bees of the United States of the genus *Xylocopa* (See Ackerman, 1916) under the name of *Xylocopa Brasilianorum Brasilianorum* Linné. The following is his description of the male and female:

Length of male, 22–24 mm.; of female, 24–26 mm.

"Female: Head black, almost as wide as thorax, well punctured, hairs black; mandibles with two large teeth at apex and a small, rounded one on the middle of the upper margin, no depressed area at the base and with but few punctures, the upper longitudinal groove very deep with a depressed spot in the middle; labrum with three lobes, the lateral ones blunter and a little hidden beneath the hairs; clypeus flat, punctures large but few, longitudinal carina not present, the upper and lateral margins shining, impunctate, the upper margin a little elevated, the lateral ones more raised and more sharply ridged toward their lower extremities; frontal shield on a slightly higher plane than the clypeus; the frontal grooves marked by a shallow suture, the lateral foveolae very small; frontal carina rather prominent, not sharply pointed, the upper side verging into a furrow concurrent with the heart-shaped groove of the median ocellus; ocelli small, the posterior ones not carinated in front but with large circular pits behind, a

PLATE XXI

Camponotus ustus Forel



(Luis F. Martorell. A Survey of the Forest Insects of Puerto Rico)

short, fine furrow midway between; eyes rather small and widely separated; vertex well punctured, the cheeks finely and sparsely so.

"Thorax black, hairs black, short and not very dense on back; disk very large, including the anterior half of the scutellum, without hair or punctures and shining; scutellum behind the flat, unpunctured area rounded and sloping downward, and pilose; post-scutellum with few punctures, small and hairy.

"Abdomen entirely black, hairs black, rather elongate, punctures close and fine on the anterior half, coarser on the posterior half; a longitudinal carina along the middle of the tergum, and a corresponding carina along the venter but much sharper and more prominent; epipygium not wide at the base.

"Wings fuliginous, violet color predominating with tints of blue and purple; tegulae black; length of wings 20 mm.

"Legs black, hairs black; tibial scale with the anterior tooth longer, narrower and more pointed than the posterior one.

"Male: The male, besides being entirely fulvous, differs as follows: Head narrower, punctation fine; mandibles brownish black, with a yellow spot at base, constricted along the middle, smaller and no tooth present on the inner margin; labrum with only one lobe; clypeus more convex, the upper margin and sides not elevated, longitudinal carina rounded; frontal carina very small and pointed, the upper margin faintly grooved with a pit in its middle; ocelli not sunken, close together, ocellar pits minute or obsolete, a shallow groove midway between the posterior ocelli; eyes not large and wide apart; lower part of antenna yellowish on first segment, otherwise yellowish brown, its upper side brownish black throughout and with no pubescence; vertex and cheeks with long, dense yellow hair and very fine punctures.

"Thorax yellow with more or less brown, especially on the post-scutellum, propodeum and sides; hairs yellow; scutellum flat, shining, with but little hair and few punctures; post-scutellum also rather flat.

"Abdomen yellow, with a brown band along the hinder margin of each segment, but this is as variable as the color may become tawny in old specimens; pilosity yellow, rufous and long at the apex; finely and densely punctured throughout. Wings semihyaline; tegulae fulvous.

"The fore legs from their bases to and including the basal part of the femora, and the intermediate and hind legs as far as the tibiae brownish black, otherwise yellow or fulvous; hairs everywhere yellow with a slight red tinge on the tibiae and tarsi; tibial scale very small and black.

"Type: Locality unknown."

Habits: The adults bore into the trunk of trees, particularly in rotten wood. Breeding is carried on, inside galleries or tunnels in the interior of

the trunk of trees, fence posts, electric posts, etc. Often the insect bores in the healthy or live wood, thus causing some damage to the tree infested.

It is very rare to see the male of the species, which is of a golden or bright yellowish-brown color flying around. The female is the form one is able to observe in the fields and gardens. On digging inside bores of infested tree trunks, males are found inside the tunnels. The habits of this insect have not yet been studied in Puerto Rico.

Host: The "cigarrón" has been recorded as boring in the trunk of the following trees:

Albizia procera (Willd.) Benth.

Ficus stahlii Warb.

Swietenia mahagoni Jacq.

White siris

"jagüey"

"caoba"

SUMMARY

This Survey is the result of eight years of studies and observations on the insect pests affecting the forest, shade and ornamental trees on the island of Puerto Rico. The work was started during the Fall of 1934, but the greatest part of it was done during the last two years from 1940 to 1942, when the project was being carried on as off-campus research work.

ORIGIN OF OUR INSECT FAUNA

Part of the introduction is devoted to a discussion of the origin of the insect fauna of the island of Puerto Rico. A short geologic review of the history of the island is presented together with the opinions of biogeographers and students of faunal dispersion in the world concerning the distribution of animal life in the Antilles. It is the general conclusion, based on such facts as the homogeneity of the Antillean fauna, its resemblance to that of Central and South America, etc., that the Puerto Rican fauna is purely of a South and Central American origin.

The discussion in the introduction leads to the following conclusions:

- (1) That our insect fauna is purely of Central and South America affinities.
- (2) That this fauna came to Puerto Rico by land migrations from Central America to Jamaica, Hispaniola and Puerto Rico, or
- (3) In a smaller degree by the migratory habits of certain groups of insects; by the activities of man and in a lesser degree by means of air currents.
- (4) The endemic species originated by means of evolution in the island, or else originated elsewhere by evolution, reaching Puerto Rico by immigration and becoming extinct in their original habitats.

PART I

(AN ANNOTATED LIST OF THE INSECTS AFFECTING FOREST, SHADE AND ORNAMENTAL TREES IN PUERTO RICO)

The first part of the work consists of an annotated list of the insects affecting the trees. The host trees are mentioned by their scientific names in alphabetical order, and the insects are listed under each species of tree. Directly under the name of each tree, the family to which it belongs is cited, followed by notes on distribution, uses or economic importance and common names of the tree species. Then the insects are listed or recorded, following more or less this sequence: insects affecting the flowers, fruits or seeds, twigs, branches, trunk and roots. Often, species attacking the decayed wood or resting on the tree will be mentioned at the end of each

tree discussed. Only the insects affecting the trees are recorded, that is, such records as "on the leaves", or "collected on the fruit", "on the trunk", etc., are not taken in consideration in this work. The parasitic forms are only mentioned when the specific host is known, otherwise parasites and predators just resting on leaves or other parts of the trees are not listed.

This Survey is based on the insect population studies on 245 tree species, belonging to 169 genera.

In the annotated list some trees only show two or three insects records while others might show thirty, forty or more records.

PART II

(A DISCUSSION OF THE MOST IMPORTANT INSECT ENEMIES OF FOREST, SHADE AND ORNAMENTAL TREES IN PUERTO RICO)

The second part of the work is an entomological discussion of the most important forms of the Insecta affecting our trees. Often, the following information is given about each insect species: general distribution of the insect; description of the adults (male and female), eggs, larval, nymphal, pupal and chrysalis stages; habits, natural enemies, applied control and host trees.

It would be really very hard to tell which are the most noxious insect pests of the forests, due to the fact that almost all of them are on the same level of importance. Only a few are outstanding as really dangerous pests of economic importance. Among the outstanding insect enemies the following can be mentioned:

<i>Nasutitermes (N.) costalis</i> (Holmgren)	"comején"
<i>Selenothrips rubrocinctus</i> (Giard)	cacao thrips
<i>Asterolecanium pustulans</i> (Cockerell)	pustule scale
<i>Pseudococcus nipae</i> (Maskell)	mealybug
<i>Saissetia oleae</i> (Bernard)	black scale
<i>Apate monachus</i> Fabricius	apate borer
<i>Apion martinezi</i> Marshall	"aceitillo weevil"
<i>Diaprepes abbreviatus</i> (Linnaeus)	"vaquita de la caña"
<i>Eulepte concordalis</i>	"roble leaf webber"
<i>Agathodes designalis</i> Guenée	"bucarc caterpillar"
<i>Hypsiphyla grandella</i> (Zeller)	cedar shoot borer
<i>Myrmelachista ramulorum</i> Wheeler	"la hormiguilla"

This work is illustrated by 18 figures and 21 plates.

RESUMEN

El presente trabajo es el resultado de ocho años de estudios y observaciones en relación con insectos que afectan los árboles de bosques, sombra y ornamentales de la isla de Puerto Rico. La labor fué iniciada durante el otoño de 1934, pero la mayor parte de la misma fué realizada durante los dos últimos años—1940 a 1942—cuando se llevó a cabo el proyecto como trabajo de investigación extramuros.

ORIGEN DE NUESTRA FAUNA INSECTIL

Parte de la introducción está dedicada a discutir el origen de la fauna insectil de la isla de Puerto Rico. Contiene la misma unas breves notas geológicas de la historia de la Isla, junto con las opiniones de biogeógrafos y estudiantes, sobre la dispersión de la fauna en el mundo, en lo que se relaciona con la distribución del reino animal en las Antillas. Es la conclusión general, basada en hechos tales como la homogeneidad de la fauna antillana, su semejanza con la de la América Central y la América del Sur, etc., que la fauna de Puerto Rico tiene un origen puramente sur y centro-americano.

De acuerdo con los hechos discutidos en la introducción, se aducen las siguientes conclusiones:

(1) Que nuestra fauna insectil es completamente afín a la de la América Central y América del Sur.

(2) Que dicha fauna llegó a Puerto Rico mediante migraciones terrestres de la América Central a Jamaica, la Española y Puerto Rico, o

(3) En menor grado, gracias a los hábitos migratorios de ciertos grupos de insectos; mediante las actividades humanas y, en escala mucho menor, por medio de corrientes de aire.

(4) Las especies autóctonas se originaron en la Isla por evolución, o se originaron en otros sitios por evolución, emigrando a Puerto Rico y extinguiéndose en su habitat original.

PARTE I

(LISTA ANOTADA DE LOS INSECTOS QUE AFECTAN LOS ÁRBOLES DE BOSQUES, SOMBRA Y ORNAMENTALES DE PUERTO RICO)

La primera parte del trabajo la constituye una lista anotada de los insectos que afectan los árboles. Se mencionan los árboles huéspedes por sus nombres científicos en orden alfabético y se enumeran los insectos bajo cada especie de árbol. Inmediatamente bajo el nombre de cada árbol, se cita la familia a la cual pertenece, seguida de las correspondientes notas, su distribución, usos, importancia económica y nombres comunes de las especies de árboles. Luego se enumeran los insectos, siguiendo, más o menos, este orden de sucesión: insectos que afectan las flores, frutas o

semillas, retoños, ramas, tronco y raíces. A menudo se mencionan, al final de la discusión que se refiere a cada árbol, las especies de insectos que atacan la madera podrida o que descansan en el mismo. Sólo se enumeran los insectos que afectan los árboles, directamente. Tales expresiones descriptivas como "en las hojas", o "recogidos en la fruta", o "en el tronco", etc. no se toman en consideración en el presente trabajo.

Las formas parasitarias se mencionan solamente cuando se conoce el huésped específico; de otro modo, los parásitos y los predadores, que sólo se detienen a descansar en las hojas o en otros sitios de los árboles, no figuran en la lista.

Esta encuesta se basa en los estudios sobre población insectil de 245 especies de árboles pertenecientes a 169 géneros.

PARTE II

(DISCUSIÓN SOBRE LOS INSECTOS MÁS IMPORTANTES QUE ATACAN LOS ÁRBOLES DE BOSQUES, SOMBRA Y ORNAMENTALES DE PUERTO RICO)

La segunda parte del trabajo constituye una discusión entomológica de las formas más importantes de los insectos que atacan nuestros árboles. Se suministra frecuentemente la siguiente información sobre cada especie: distribución general del insecto; de los imagos (macho y hembra), huevos, estados de larvas, ninfas, pupas y crisálidas; hábitos, enemigos naturales, control aplicado y árboles huéspedes.

Sería realmente muy difícil informar cuales son las plagas de insectos más nocivas a los bosques, debido a que casi todas tienen el mismo grado de importancia. Sólo unas cuantas se destacan como plagas realmente peligrosas de importancia económica. Entre los insectos enemigos más conspicuos podemos mencionar los siguientes:

<i>Nasutitermes (N.) costalis</i> (Holmgren)	comején
<i>Selenothrips rubrocinctus</i> (Giard)	candelilla del cacao
<i>Asterolecanium pustulans</i> (Cockerell)	queresa pustulosa
<i>Pseudococcus nipae</i> (Maskell)	chinche harinosa
<i>Saissetia oleae</i> (Bernard)	queresa negra
<i>Apate monachus</i> Fabricus	taladrador del cafeto
<i>Apion martinezi</i> Marshall	gorgojo del aceitillo
<i>Diaprepes abbreviatus</i> (Linnaeus)	vaquita de la caña
<i>Eulepte concordalis</i>	tejedor de las hojas del roble
<i>Agathodes designalis</i> Guenée	oruga del bucare
<i>Hypsipyla grandella</i> (Zeller)	taladrador del retoño del cedro
<i>Myrmelachista ramulorum</i> Wheeler	la hormiguilla

El presente trabajo ha sido ilustrado con 18 figuras y 21 planchas.

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